V. *Birds as a Factor in the Production of Mimetic Resemblances among Butterflies.* By Guy A. K. Marshall, F.Z.S.

[Read March 3rd, 1909.]

The question whether birds do, or do not, prey upon butterflies to any appreciable extent is one which has from time to time engaged the attention of Entomologists for some years past. For it has been contended that the validity of the theories of mimicry enunciated by H. W. Bates and Fritz Müller, as applied to butterflies, must largely depend upon the production of adequate evidence to show that these insects are liable to habitual attacks upon the part of birds. Nor is it possible to deny the reasonableness of such a contention, as soon as we endeavour to reconstruct mentally the processes which must have been at work if those theories be true.

Defences of Butterflies.

In their imago state butterflies appear to be among the most defenceless of insects, for their comparatively large size and diurnal habits render them more or less conspicuous objects when on the wing, even though their actual colouring may be dull and obscure. They have, however, three principal lines of defence: (1) rapid or tortuous flight; (2) procryptic under-side coloration, combined with the appropriate instincts for seeking concealment; and (3) the possession of nauseous qualities rendering them distasteful to a large proportion of their enemies.

The existence of these latter qualities has now been experimentally proved beyond the possibility of cavil, and we are probably justified in assuming that they occur in all species of Danainae, Ithomiinae, Heliconinae, and Acraeinae. They have also been shown to exist in certain isolated genera of Nymphalinae, Lipteninae, Pierinae, and Papilioninae; but there does not appear to be any real justification for the speculative assumption that they are of general occurrence in these and other subfamilies.

Wherever undoubted distastefulness has been demonstrated by experiment, we find that the species are invariably characterised by a slow, sailing or laboured flight; moreover they do not (except in a very few instances) exhibit any procryptic coloration on the undersurface. Thus the acquisition of unpalatability, which is probably a more specialised form of defence, leads to a partial or complete abandonment of the other two methods. This is only what we should anticipate in accordance with Wallace's law of warning coloration. For distastefulness loses a great part of its protective value unless accompanied by coloration or habits which make for conspicuousness and thus advertise the unpleasant qualities of the insect.

But the diminution of activity in flight can have significance only in relation to winged enemies; that is to say, either birds or predaceous insects. Of the latter the only ones of general occurrence which are known to attack butterflies are Asilid flies, wasps and dragonflies. With regard to Asilidae, Professor Poulton has clearly shown in his admirable paper on predaceous insects (Trans. Ent. Soc. Lond., 1906, p. 363) that these flies are apparently indiscriminate in their attacks on other insects and do not appear to be deterred by any nauseous qualities. There seems to be a certain amount of evidence to show that the same is true of wasps, including Belt's record of the wasp which stocked its nest with *Heliconii*; and probably this applies to dragonflies also, though there is very little evidence at present as to the nature of their food (cf. Poulton, *l. c.* p. 399). But conspicuous colouring and slow movements can be of no utility against enemies which devour with equal avidity both nauseous and normal forms; indeed, rather the reverse. It is therefore difficult to avoid the conclusion that the modification of flight which is so constantly correlated with unpalatability in butterflies must have a particular significance in regard to the attacks of birds.

The Influence of Lizards on Mimicry.

That certain species of lizards will in a wild state eat butterflies is well established, and it has often been suggested that these reptiles play a considerable part in the production of butterfly mimicry. Yet the evidence

in this direction does not seem to be altogether satisfactory as it stands at present. In South Africa, at all events, the vast majority of lizards live only on the ground or among rocks, and personally I have never met with any truly arboreal species. Yet it is among the tree-frequenting butterflies that warning colours and mimicry find their highest development; nor can I call to mind any undoubtedly mimetic butterfly which normally settles on rocks or on the ground, with the exception of a few species such as *Aterica galene* or *Papilio echerioides*, which only frequent dense forests—localities in which ground lizards are, so far as my own experience goes, conspicuous by their entire absence. Indeed, the habits of the South African Danaines and their many mimics are such as to render it antecedently improbable that they are normally liable to be preyed upon by lizards. It is possible that the conditions are quite different in other tropical countries, but the question does not appear to have been investigated from this point of view, and further observations are to be desired.

Objections to the View that Birds attack Butterflies.

It is now about twelve years ago that this question was discussed at some length at a meeting of this Society (Proc. Ent. Soc., 1897, pp. xiii–xxvi) as the outcome of an interesting paper by Dr. Dixey on the subject of mimetic attraction. Judging by the views advanced during this discussion, as well as those published by other observers, it would appear that a considerable majority of entomologists are of opinion that on the whole butterflies suffer but little from the attacks of birds.

The supporters of these adverse views who are most usually cited in criticisms directed against the theories of mimicry are Scudder (whose experience is confined to N. America), Packard (N. America), Pryer (Japan and Borneo), Piepers (Java) and Skertchley (Borneo). But in regard to Scudder it must be noted that, though he has seen but few cases of birds pursuing butterflies in N. America, yet he readily admits that such occurrences are probably much more frequent in tropical countries (Butterfl. of Eastern U.S., II, p. 1612). Similar negative evidence has more recently been put forward by Sir George Hampson,

from India (Proc. Ent. Soc., 1897, p. xxxviii); Commander J. J. Walker and Col. Yerbury (*l.c.* p. xxxix); J. C. Kershaw, from S. China (Trans. Ent. Soc., 1905, p. 6); Paul Hahnel, from Tropical S. America ("Iris," 1890, pp. 310–321); while Packard has quoted the opinions of a number of his North American correspondents to the same effect, and has generally reviewed the whole subject in a sense adverse to the theory of mimicry in a very able paper entitled "Origin of Markings of Organisms" (Proc. Amer. Phil. Soc., 1904, pp. 393-450), a paper which has been excellently criticised in our Proceedings for 1906 (p. xxxvii) by Eltringham.

The evidence adduced by these authors is necessarily of a purely negative character, being always to the effect that each of them has collected or observed butterflies for a shorter or longer period and yet has not seen any, or at most very few, cases of birds eating butterflies. In dealing with the theories of mimicry most of them are content with a purely destructive criticism, and make no attempt to explain the mass of facts which has now been accumulated by Professor Poulton and his correspondents. Others, such as Hahnel, Skertchley, Eimer, etc., have attempted to suggest alternative theories to explain these striking phenomena. Unfortunately some of the critics have not even taken the trouble to grasp the real nature of the suggestions which they criticise (this is especially true of Fritz Müller's views); and while they unite in condemning the theories of mimicry on the ground that they involve too many assumptions for which there is no experimental evidence, it is noticeable that this criticism applies with even greater force to their own hypotheses, quite apart from the far graver objections which may be raised against all of them. The vague suggestion that mimetic resemblances are all due to the direct action of a similar environment furnishes an excellent example of the ill-digested and wholly inadequate conceptions which pass current among many entomologists who have not made themselves acquainted with the mere rudiments of the subject. But it is not my purpose to discuss these questions here. For in the first place, I am by no means prepared to accept the fundamental assumption which underlies all these alternative interpretations, namely, that at the present time the influence of birds upon butterfly coloration is a negligible quality; and secondly, because

the grave difficulties in the way of accepting any explanation of mimetic resemblances other than Natural Selection have already been very clearly set forth in an admirable paper by Professor Poulton (Journ. Linn. Soc. Zool., xxvi, pp. 558–612), which has been recently reproduced in his book "Essays on Evolution," and which it would be well for any would-be critics of the theory of mimicry to "read, mark, learn and inwardly digest" before putting pen to paper.

But to revert to the question of birds, it is clear that the above negative statements have been generally accepted without proper consideration. When a naturalist who has spent some time in the tropics expresses a decided opinion to the effect that birds do not normally eat butterflies, because he has never observed them doing so, it is incumbent upon us, before accepting his evidence as having any real scientific value, to satisfy ourselves that he has made a systematic and thorough investigation of the subject, and that his views are not based merely on casual and inadequate observations. For in a matter of this kind there is grave danger that absence of evidence may be due simply to lack of observation. If a collector maintains that birds do not eat butterflies, we are justified in asking him for a full list of the other insects which he *has* seen captured by birds. And I venture to think that a closer inquiry of this kind would reveal the fact that most of the negative evidence which has been brought up against the Selectionist interpretation of mimicry is really of little worth.

Some Reasons for the Paucity of Evidence.

There can be no question that the published records of birds attacking butterflies are limited in number, though perhaps more numerous than generally supposed. If then we believe that such attacks are really of comparatively frequent occurrence in certain regions, how are we to account for the fact that so few observations have been recorded? Certain aspects of this question were dealt with by Mr. Trimen in his Presidential Address to this Society in 1897 (Proc. Ent. Soc., p. lxxxix), when he said: "I am persuaded that . . . the dearth of evidence is due to the neglect of well-directed and sustained observation. Little can be gained by merely noting such cases as

happen to force themselves on the collector's attention; the collector must resolutely set himself to search out and keep watch upon what really takes place. Seeing that there is no record of any naturalist's having seriously taken up the investigation of this matter in the field, I think that very much positive evidence could hardly be expected, and that what has been published goes far in the direction of proving that birds must still be reckoned among the principal enemies of butterflies." We must likewise bear in mind that *ex hypothesi* we may expect the attacks of birds to be comparatively infrequent in all those places where mimetic resemblances among butterflies are rare or absent. It is in the region of tropical forests, where both birds and insects are plentiful, that this phenomenon attains its greatest frequency and its highest perfection; but it is precisely in such localities that adequate observations are most lacking. The few entomologists who visit these favoured spots are, not unnaturally, too much preoccupied in the task of mere collecting to be able to devote themselves to long and possibly tedious observations of this kind. And only those who have actually tried it can realise how much time and patience is requisite to obtain even small results, unless the conditions for observation are very exceptionally favourable. Still there can be little doubt that in suitable localities even the busiest collector might add at least a few crumbs to our store of knowledge if he would but keep his eyes open for such occurrences and carefully note the details at the time. In this connection I may quote the remarks of that excellent observer, Dr. Franz Doflein, of the Munich University, who, in his interesting book on his travels in the East, has made some valuable contributions to the present subject ("Ostasienfahrt," 1906, pp. 440–446). He there says: "From the observations which I made in the jungles of Ceylon it is quite incomprehensible to me how naturalists who have spent years and tens of years in the tropics can deny this fact [that butterflies are frequently attacked by birds]. I can only suppose that during their wanderings they pay no special attention to such occurrences, so that when on their return they take part in theoretical discussions, they search their memories and their note-books in vain for records of such observations."

As an instance of the manner in which such facts

may be easily overlooked, I may refer to the case of the kestrel in England. I have searched in vain through many books on British Ornithology for any record that this bird eats butterflies; nor is it even mentioned in Naumann's "Vögel Deutschlands" (1822), which contains much more information of this kind than most modern works. Yet in the "Entomologist" for 1903 (p. 68) there is a most interesting account by Mr. Parkinson Curtis of the behaviour of a kestrel which he observed for some hours on the Ballard Down, near Swanage. The bird was seen to stoop on several occasions at something on the ground, but always rose again without carrying off anything. Most entomologists would have troubled themselves no further about the matter, but, fortunately, Mr. Curtis was prompted to make a closer investigation, and by carefully stalking the bird he found that it was pouncing upon butterflies which it tore to pieces on the ground. In the course of an hour he counted about thirty-six specimens which were captured in this manner, and the bird was observed to continue the pursuit for at least five hours. Nor is this merely an isolated case, for Mr. Curtis has confirmed his observation in every succeeding summer; moreover we have the evidence of Mr. Colthrup that he has seen the kestrel feeding on *Polyommatus corydon* (see p. 352) in 1906 and 1907 on Beachy Head. It is therefore probable that further enquiry will show this to be quite a usual habit of the kestrel which has hitherto been overlooked; and it seems quite conceivable that dozens of entomologists may have collected on Beachy Head and Ballard Down and have remained in ignorance of the destruction of butterfly life which may have been going on in their very presence. Again I can find no record of butterflies being eaten by the Garden Warbler (*Sylvia hortensis*), with the exception of the one published by Professor Kennel (see p. 344), who observed a pair which fed their young almost exclusively on butterflies all day long. It would be unreasonable to suppose that this must be an abnormal case; it seems far more likely that this Warbler does often capture butterflies, but that naturalists have failed to observe the fact, or else failed to record their observations. A final instance may be referred to, namely, the Pigmy Falcons (*Microhierax*) of the East. My lamented friend, the late Col. C. T. Bingham, who lived for many

years in Burma, where these birds are not uncommon, only once observed a butterfly to be seized by one of them. It might be argued that if so admirable and skilled an observer, in the course of a long experience, saw this happen only on a single occasion, the pursuit of butterflies must be an unusual habit with these birds. But fortunately, we have some indirect evidence on this point which aptly illustrates how extremely misleading such an argument may be. These hawks nest in holes in trees, the bottom of the hole being lined with a thick pad composed chiefly of insect remains mixed with rotten wood. Now three different observers have found nests in which this pad consisted largely, or even principally, of butterflies' wings, thus rendering it extremely probable that the Falconets do prey upon these insects to a very considerable extent.

But if records of birds taking butterflies are scarce, it must be borne in mind that the same thing applies to almost all orders of insects. For example, although Coleoptera are very largely eaten by birds, yet it must be admitted that our knowledge of that fact is not really based on direct observation of capture, but is derived from an examination of the contents of birds' stomachs ; and it is probable that the number of authentic records of capture would be even less in the case of beetles than in butterflies. If it be urged that the small size of most Coleoptera renders their recognition difficult under such conditions, let us turn to the dragonflies, which afford a very fair parallel to butterflies, so far as size and habits are concerned. Here again my examination of the literature of the subject shows that the observed cases of capture, or even pursuit, are extremely few ; and personally, during fifteen years of field experience in South Africa I cannot recollect to have ever seen a bird pursue a dragonfly. But I am by no means prepared to assume from these facts that birds never, or very rarely, attack dragonflies; rather do I believe that this dearth of evidence is simply due, as it certainly is in my case, to the fact that no attention has been paid to this line of inquiry. This belief is borne out by the knowledge that where birds' stomachs have been critically examined the occurrence of dragonflies has been noted in quite a number of cases. An exhaustive examination of the insect remains found in the stomachs of wild birds, must, in most cases, afford the only satisfactory testimony as to what constitutes their normal food; but no such in-

vestigation has ever been undertaken in those tropical regions where mimicry among butterflies is most prevalent, and where we should therefore expect to find the greatest destruction by birds. Moreover, this line of inquiry is unfortunately much less satisfactory in the case of butterflies than in most other insects, owing to the fact that birds so frequently snip off the wings before eating them, thus rendering their recognition almost impossible; and there can be little doubt that the presence of butterflies in birds' stomachs must have been overlooked through this cause. Thus it is rather to ornithologists that we must look for any material addition to our knowledge of this subject; and an attempt to carefully identify the food brought to their young by insectivorous birds would probably yield much valuable information.

Enough has now been said to show that the assumption that birds seldom attack butterflies is certainly premature; and for my part, I am convinced that when the subject has been more fully and systematically investigated that assumption will prove to be entirely unfounded.

We may now turn to the list of available records. So far as concerns those already published, I believe it to be fairly complete, though a certain number must inevitably have escaped my attention. For the remainder I have to offer my hearty thanks to the following friends and correspondents, who have very kindly furnished me with a number of valuable unpublished observations: Mr. Parkinson Curtis, Professor C. B. Davenport, Dr. F. A. Dixey, Dr. F. Doflein, Mr. C. H. B. Grant, Colonel N. Manders, Mr. S. A. Neave, Father O'Neil, Professor E. B. Poulton, Mr. R. Shelford, Mr. C. F. M. Swynnerton and Professor August Weismann.

The number of Observations is unfortunately still too small to justify any broad generalisations from the results shown, but a few salient points may be noted.

The paucity of records in the case of Lycaenidae and Hesperiidae is probably due to the comparatively small size of these insects, which would thus render them difficult to identify under such conditions. The great majority of the evidence is furnished by the Nymphalinae and Pierinae, and of these the latter subfamily is always easily first. This is in accordance with Bates' experience on the Amazons. For he says: "I could not, from their excessive scarcity, ascertain on the spot that the *Leptalides*

were thus picked out. I noticed, however, that other genera of their family (Pieridae) were much persecuted" (Trans. Linn. Soc., xxiii, 1862, p. 511). And in the same region Paul Hahnel noted that Pierines were more attacked by birds than any other butterflies ("Iris," 1890, p. 193). These facts render it difficult to accept the view, advocated by Dr. Dixey and Professor Poulton, that the Pierinae probably constitute a generally unpalatable group.

As might have been expected, the number of instances in which birds have been observed to eat butterflies of the dominant distasteful groups, such as Danainae or Acraeinae, is comparatively small. Were these insects as liable to be consumed as the Nymphalinae and Pierinae, it seems likely, owing to their conspicuous appearance and avoidance of concealment, that far more such cases would have been forced upon the attention of casual observers.

Again, it may be noted that many observers have testified to the fact that it is by no means an easy task for a bird to capture a butterfly in full flight, this being true even of such adepts as the Bee-Eaters. My own experience is entirely in accord with this opinion; and we may perhaps find here an explanation why a bird may often be seen sitting apparently impassive and uninterested in the butterflies which are flying in the vicinity; the lack of interest being due to the knowledge that open pursuit is of little avail. It seems likely that attacks will in general be made only under specially favourable conditions, such as, when the butterfly passes very close to the bird's perch, or when the attention of the insect is distracted during feeding, courting, ovipositing, etc. We are, therefore, probably justified in supposing that flight does really afford an important protection to butterflies against the attacks of birds. On the other hand, it has been suggested that flight is probably of minor importance in this connection, and that birds do not commonly pursue butterflies simply because the vast majority of these insects possess distasteful qualities to a greater or less extent. This view I am quite unable to accept, for various reasons which need not be discussed here; nor can it be said to find support in the following records, which indeed furnish strong evidence against it. For several observers, including Prof. Weismann, have testified that butterflies bred in confinement and then released

are specially liable to attack by birds on account of their weak flight (cf. Palaearctic records, 4. *g.*; 10. *d.* and *e.*; 28. *e.*). The point might be decided experimentally by releasing a large number of butterflies whose wings had been partly cut off, then turning loose uninjured specimens of the same species and noting any difference in the attitude of the birds towards them. I have suggested to several of my friends in the tropics that they should undertake such experiments, which might, moreover, prove extremely valuable as a means of ascertaining the likes and dislikes of wild birds under natural conditions.

Finally, it may be interesting to note that the Indian Bee-Eaters appear for the most part to cut off the wings of butterflies which they capture before eating them; whereas the African species, so far as I can ascertain, appear to swallow them whole. It is not easy to understand the reason of this discrepancy in habits in closely allied species.

With reference to the following records it must be noted that where authors have given long lists of insects preyed on by certain birds, for the sake of brevity only those parts which refer to butterflies have been cited. This is especially the case in the Nearctic records from Gentry's "Life Histories of the Birds of E. Pennsylvania," and also in the Palaearctic records from Naumann's "Vögel Deutschlands."

Records from the Palaearctic Region.

1. *Corvus monedula*, Briss. (Jackdaw). Observed to catch a white butterfly: The Editor, "Country-Side," 1903, p. 290.
2. *Sturnus vulgaris*, L. (Starling). (*a*) "I have often seen them chasing butterflies" (England): R. Fortune, in Watson's "Ornithology in Relation to Agriculture" (1893), p. 139.—(*b*) A starling observed to catch a white butterfly: The Editor, "Country-Side," 1903, p. 290.
3. *Oriolus galbula*, L. (Golden Oriole). "It then [in May] feeds principally on woodland insects, . . . catching cockchafers, butterflies and also large thick-bodied moths, etc.": Naumann, "Vögel Deutschlands," ii, p. 179 (1822).

4. *Passer domesticus*, L. (Sparrow). (*a*) "I have frequently seen the common sparrow chase and capture such butterflies as *V. urticae* and *P. rapae*": T. G. B. (Cambridge), "Nature," iii, 1870, p. 166.—(*b*) "I have noticed . . . three sparrows for some time chase and eventually capture a female *Epinephile janira*": R. Trimen, Proc. Ent. Soc. L., 1897, p. xci (England).—(*c*) "I have certainly observed sparrows catching butterflies": W. Caspari, Soc. Ent. Zurich, xvi, 1901, p. 34 (Switzerland).—(*d*) A sparrow observed "chasing a specimen of *Vanessa urticae*, at Whitstable, which it captured": C. W. Colthrup, "Entomologist," 1903, p. 173.—(*e*) "I can remember having once witnessed a sparrow chase and catch a fine specimen of *Argynnis adippe*": C. Floersheim, "Ent. Record," 1906, p. 36.—(*f*) "In my garden at Munich a *Vanessa c.-album* was pursued and captured by a sparrow, on the 3rd July, 1906": Dr. Franz Doflein (*in litt.*).—(*g*) "In the experiments in rearing Vanessidae in Battersea Park [London] a few summers ago . . . the sparrows at once found out the difference between those reared under glass and the wild ones, and soon exterminated them": E. T. Daubeny, "Nature Notes," Oct., 1905, p. 197.—(*h*) "June 7, 1906. Kensington Gardens [London]. In the wide grassy space east of the palace, passing down to the Serpentine, I saw a large *Vanessa* (looking like *V. polychloros*) flying in the sunshine. It was pursued by a sparrow, which made two ineffectual attempts to catch it and then desisted. The chase was immediately taken up by another sparrow, and pursuer and pursued disappeared from view among the trees": Dr. F. A. Dixey (*in litt.*).—(*i*) At Fawley, near Southampton, on the 13th June, 1907, I myself saw a sparrow catch and eat a *Picris rapae*.—(*j*) "The sparrow, I have frequently observed, attacks *Picris brassicae* and *P. rapae* on the wing, but is not very successful as a rule. I can only remember two instances of capture. I have also seen it on three occasions attack *Macroglossa stellatarum*, but in every case unsuccessfully": W. Parkinson Curtis (in a letter to Prof. Poulton, dated 22, ix, 1905).—(*k*) "Colonel Coussmaker remarked to me that he had seen sparrows taking butterflies, including the common 'whites,' far more frequently than any

other birds; probably, I imagine, because commoner than any other birds": C. F. M. Swynnerton (letter dated 1, viii, 1907).—(*l*) "For the first time in my life I saw this summer a sparrow pursue and catch a Large Tortoiseshell that was flying round an elm tree": O. H. Latter (in a letter to Prof. Poulton, dated 31, xii, 1902).—(*m*) A sparrow observed to eat a *Pieris rapae*, of which it cut off the wings: L. H. Harris, "Country-Side," 1907, p. 140.—(*n*) "Small Tortoiseshell chased by a sparrow, which only succeeded in taking a piece out of one wing": J. R. Harding, "Country-Side," 1907, p. 209 (England).—(*o*) "Last year I bred a large number of the large white butterfly, which emerged from the pupae this year. On letting some of the butterflies go, two of them were immediately seized by house sparrows, which only ate the body and left the four wings behind. On two other days the same thing happened. In all, four were killed in this way, and they were all males": G. Blackburn, "Country-Side," 1907, p. 211 (England).—(*p*) "Sparrow seen to take a peacock butterfly in full flight": J. J. Towns, "Country-Side," 1907, p. 307 (England).—(*q*) "From interesting and numerous letters in answer to the question whether birds eat butterflies, I find that thirty-eight correspondents have seen the sparrow catch and in most cases devour common white butterflies. . . . Five correspondents have seen the sparrow eat the brimstone; two have seen it catch, or partly eat, the meadow-brown; two the small blue; one a large fritillary; and one a tortoiseshell": The Editor, "Country-Side," 1903, p. 290 (England).—(*r*) Prof. E. Pénard of Geneva saw a bird, probably a sparrow, persistently pursue and at the third attempt capture a white butterfly (probably a species of *Pieris*)": Prof. E. B. Poulton, "Essays on Evolution," p. 282, note.

5. *Acanthis cannabina*, L. (Linnet). To my astonishment a linnet (Hänfling), which was singing on a tree-top, suddenly became silent and swooping down adroitly captured an *antiopa*": B. Slevogt, Soc. Ent. Zurich, xvii, 1901, p. 82 (Switzerland).
6. *Parus sp.* (Tit). (*a*) "Captures with astonishing accuracy the butterflies which flit about the trees": W. Caspari, "Soc. Ent. Zurich," 1901, p. 34.—(*b*) A

tit observed to eat a white butterfly: The Editor, "Country-Side," 1903, p. 290 (England).

7. *Parus major*, L. (Great Tit). "I have seen a great titmouse capture the White Butterfly (*Pieris rapae*) on the wing": W. Eagle Clarke, quoted by Prof. Poulton, "Nature," lxv, p. 465 (England).
8. *Motacilla sp.* (Wagtail). (*a*) A good account of the pursuit and final capture of a Small Tortoiseshell (*Vanessa urticae*, L.) by this bird. The observer infers from the method used by the bird "that it was not a mere attack brought on by curiosity, but the result of experience, which had taught it that the body and not the wings was the desired tit-bit": H. J. Turner, "Ent. Record," 1904, p. 335 (England). —(*b*) A wagtail observed to catch a white butterfly: The Editor, "Country-Side," 1903, p. 290 (England).
9. *Pratincola rubetra*, L. (Whinchat). "On another evening, August 16th, 1907, at Beachy Head, I watched a pair of furze-chats picking specimens of [*Polyommatus*] *corydon* off grass stems and taking them to a small tree. On going to the tree to investigate, the two birds flew off together with a brood of young ones. Under the tree on the ground were about thirty or forty wings of male *corydon*": C. W. Colthrup, "The Country-Side," March 21, 1908, p. 267.
10. *Phoenicurus phoenicurus*, L. (Redstart). (*a*) "They take flies, gnats, small butterflies and all sorts of small two- and four-winged insects, partly on the wing and partly at rest": Naumann, "Vög. Deut.," ii, p. 519.—(*b*) "It feeds on flies, gnats, small butterflies and various other kinds of small coleopterous and other insects, caterpillars, etc.": H. Dresser, "Birds of Europe," ii, p. 281.—(*c*) "I have also repeatedly observed in my own country [Switzerland] how the Redstart (Rotschwänchen), which seems to have a special liking for butterflies, would catch 'Whites' on the wing and take them to the nest": Prof. L. Kathariner, "Biol. Centralb," 6. xviii, 1898, p. 681.—(*d*) The author states that every year he was in the habit of releasing hundreds of butterflies (especially *Vanessae*) bred in temperature experiments, and that the birds of the neighbourhood would then congregate and pursue the insects, whose flight was still weak. He notes that a pair of red-

starts were especially active in their attacks. On the other hand *Arctia caja* was never touched : C. Frings, "Soc. Ent. Zurich," 1900, p. 76 (Switzerland). —(*c*) "About fifteen years ago I bred numbers of *Vanessa io* and *urticae* every summer; I released many of the thousand specimens of butterflies that I obtained. Every summer I began by letting the insects fly out of the window of my work-room. But very soon this was noticed by the birds in the garden which surrounds the Institute, and then a redstart used generally to station itself on a neighbouring bush or tree and carry off most of the butterflies which were released. I often saw the bird fly quite close to the open window, seize a butterfly, turn quickly round and fly away again. Then it would tear off the wings and one would find afterwards many wings of *V. io* and *urticae* lying on the ground. . . . In dull weather most of the butterflies did not fly away, but remained sitting on the window-ledge. Then the bird (*Ruticilla phoenicura* or *tithys*) would come right up to the ledge. . . . My assistant Dr. Schleiss once released, instead of myself, a number of *urticae* from the window. The redstart appeared immediately, and in a short time he saw lying on the garden path about thirty wings of *Van. urticae*" (Freiburg in Breisgau) : Prof. August Weismann (in a letter to Prof. E. B. Poulton, dated 14, ii, 1909).

11. *Accentor modularis*, L. (Hedge Sparrow). "On the May 15 [1907] I saw a hedge sparrow capture a freshly emerged *Pieris rapae* ♂ and devour it. The specimen was insufficiently dried to be strong on the wing, and was captured whilst indulging in a first unsteady flight. The occurrence took place at Broadstone, Dorset" : W. Parkinson Curtis (letter to Prof. Poulton, dated 29, v, '07).

12. *Erithacus rubecula*, L. (Robin). (*a*) "I can certify to the fact of robins chasing and catching large white butterflies on the wing and swallowing them whole" : H. Fox, "Nature," lxi, 1899, p. 152 (England).—(*b*) "I saw a male robin once strike at *Pyrameis atalanta*, but, on the butterfly turning, he made no further attempt" : C. Floersheim, "Ent. Record," 1906, p. 36. —(*c*) "I had [September 1900] a number of *Colias edusa* ♀ sleeved in a small hand-frame with clover to

induce them to lay eggs, but they came to an untimely end. I saw a robin industriously pecking at the muslin covering the frame, and shortly after being disturbed he returned, started again where he had weakened the muslin, and forcing his way in, slew and ate all the *Colias edusa*. The *edusa* were visible through the muslin and were walking about on the clover. . . . The same robins this spring destroyed some female *cardamines* under similar circumstances": W. Parkinson Curtis (in a letter to Prof. Poulton, dated 22, ix. 1905).—(*d*) The robin has been seen to chase, catch or eat common white butterflies by five correspondents; while two have seen it take blue butterflies: The Editor, "Country-Side," 1903, p. 290 (England).

13. *Turdus viscivorus*, L. (Missel Thrush). Observed to catch a white butterfly: The Editor, "Country-Side," 1903, p. 290.
14. *Acrocephalus palustris*, Bechst. (Marsh Reed Warbler) "They seek many kinds of insects, such as . . . small dragon flies, Phryganidae, Tineidae and small butterflies": Naumann, "Vög. Deut." iii, p. 640.
15. *Acrocephalus schaenobaenus*, L. (Sedge Warbler). A pair of Sedge Warblers was observed of which "each had a butterfly in its mouth, and with my field-glasses I was able to identify the species as a Meadow-Brown (*E. janira*) and a Small White (*P. rapae*)": O. H. Latter, "Nature," lx, 1899, p. 520 (England).
16. *Sylvia hortensis*, Bechst. (Garden Warbler). In 1895 at Dorpat, in Russia, Prof. Kennel observed a pair of Garden Warblers (Grasmücken) "which fed their five young all day long almost exclusively with *Vanessa urticae*, and occasionally with a few *Parnassius ame-mosyne* [*mnemosyne*] and *apollo*, the latter being a very scarce species in the neighbourhood." He subsequently adds that *Pieris rapae* was also used as food by these birds: Prof. J. Kennel, "Biol. Centralb.," xviii, 1898, p. 810.
17. *Sylvia curruca*, L. (Lesser White-throat). "But they also eat various insect-eggs, small pupae, many small two- and four-winged insects, different species of green plant-lice (*Aphis*, Linn.), small butterflies and so forth": Naumann, "Vög. Deut." ii, p. 457.
18. *Phylloscopus trochilus*, L. (Willow Wren). Observed

to catch a white butterfly: The Editor, "Country-Side," 1903, p. 290.

19. *Regulus regulus*, L. (Golden-crested Wren). The Gold-crest (Goldhänchen) also captures butterflies which flit about the trees: W. Caspari, "Soc. Ent. Zur.," xvi, p. 34.
20. *Troglodytes troglodytes*, L. (Wren). This bird was observed to persistently enter a house and carry off a considerable number of hibernating *Vanessa urticae*: A. Elliott, "Ann. Scot. Nat. Hist." 1900, p. 53 (Scotland).
21. *Lanius minor*, Gm. (Lesser Grey Shrike). (*a*) Its food "consists of butterflies, various beetles, grasshoppers and other insects": Naumann, "Vög. Deut." ii, p. 20.—(*b*) A *Papilio podalirius*, L. was found in the stomach of one *Lanius minor*: E. Csiki, "Aquila," xi, 1904, p. 278.
22. *Lanius auriculatus*, Müll. (Woodchat Shrike). "It feeds on beetles, grasshoppers, butterflies, dragonflies, and various other insects which it catches on the wing": Naumann, "Vög. Deut.," ii, p. 27.
23. *Lanius collurio*, L. (Red-backed Shrike). (*a*) "It also catches with dexterity flying beetles, butterflies, grasshoppers, and so forth": Naumann, *l. c.* p. 35.—(*b*) "On July 2, 1896, on Patcham Railway Embankment, near Brighton, I found a *Pieris rapae* ♂ impaled on a sharp sedge by a red-backed shrike. It was pinned neatly through the centre of the thorax and was running round on the pivot thus formed when I investigated it": W. Parkinson Curtis (letter to Prof. Poulton, dated 22, ix, 1905).
24. *Muscicapa grisola*, L. (Spotted Flycatcher). (*a*) "It feeds on flies, especially of the Linnean genera *Musca* and *Conops*, on gadflies, gnats, crane-flies, butterflies, small grasshoppers, small dragonflies and various other insects": Naumann, *l. c.* ii, p. 220.—(*b*) "I have seen the common flycatcher take butterflies more than once. I can well remember how gracefully one swept from the bough of a chestnut and caught a *Lasiommata aegeria* in its flight": R. C. R. Jordan, "Ent. Mo. Mag.," xxiv, 1887, p. 86.—(*c*) "I have seen the common spotted flycatcher pursue a butterfly and miss it, giving up the pursuit (H. S. Wise)": Lilian Vesey, "Nature," lxv, 1902, p. 392.—(*d*) "I was chasing a Clouded Yellow (*Colias edusa*, F.) . . . when, much

to my chagrin, a Spotted Flycatcher (*Muscicapa grisola*) darted from a fence and caught it": A. H. Hamm, "Nature," lxv, 1902, p. 366 (England).—(*e*) "On July 21st [1904] we saw at Evian-les-Bains (France) a spotted flycatcher catch a brown butterfly, almost certainly *Epinephele jurtina*": Alfred Sich, "Entom. Rec.," 1904, p. 268.—(*f*) "After a storm a grey flycatcher darted at a flying white butterfly (Cabbage White ?). At the second attack it seemed to have damaged the butterfly's wings, for the latter, in spite of all its fluttering, came nearer to the ground. It was only at the third attempt that the bird succeeded in catching the butterfly, which it immediately swallowed whole": A Hölscher, "Ill. Zeits. Ent.," 1899, p. 91 (Osnabrück).—(*g*) "Aug. 23, 1903. Fellows' Garden, Wadham College [Oxford]. Saw a flycatcher seize and fly off with a white butterfly on the wing. After being carried for a little distance the butterfly escaped and was chased by the flycatcher, which made four or five ineffectual attempts at recapture, at each of which I distinctly heard the snap of the bird's beak. The chase disappeared behind trees, and I did not see the result; my impression is that the butterfly escaped": Dr. F. A. Dixey (*in litt.*).—(*h*) "Aug. 28, 1903. Grounds of Alexandra Palace, Muswell Hill, near London. Saw a flycatcher settled with what appeared to be a white butterfly in its beak. In a short while I saw the wings detached and fall to the ground, but on searching afterwards I failed to find them. The grass was long and there was a good deal of undergrowth": Dr. F. A. Dixey (*in litt.*).—(*i*) "A small tortoiseshell butterfly, which had been weakened by fluttering in a window, on being liberated was at once pounced upon and eaten by a flycatcher": E. T. Daubeny, "Nature Notes," October 1905, p. 197.—(*j*) "This summer (1905) a pair of Flycatchers (*Muscicapa grisola*) nested in a garden belonging to a friend of mine. I saw this bird catch, kill and eat *Pieris rapae* ♂. One specimen only was attacked, and this happened to pass close to the bird's favourite seat": W. Parkinson Curtis (letter to Prof. Poulton, 22, ix, '05). —(*k*) "On July 30 [1907], as I was walking with Col. Coussmaker [in Surrey], I saw a flycatcher (*M. grisola*) swoop low over the grass and return to its

perch with a 'meadow-brown' in its bill. The butterfly was held by the wings only, body outwards, and the bird had hardly reached the perch when the insect escaped and disappeared behind some foliage, with the flycatcher again in hot pursuit": C. F. M. Swynnerton (in a letter dated 1, viii, 1907).—(*l*) "Mrs. Blackburn [of Barrow Hill, Henfield] made the remark that their 'meadow-browns' (*janira*) were so caught and eaten by the flycatchers as to be quite scarce; when one of them appeared it was generally snapped up, and sometimes two flycatchers would help each other in the capture. The common white butterflies (*rapae*, etc.), were sometimes, but rarely, attacked": F. Merrifield (in a letter to Prof. Poulton, dated 7, viii, 1907).—(*m*) "I was walking round the paddock [New Barnet, Herts.] yesterday when a large cabbage butterfly came flying across it. There were three Flycatchers (*M. grisola*) in sight. The butterfly passed the first without being attacked, but settled in the grass just in front of the second and about ten yards from it. The bird, which had been watching it, continued to do so for two or three seconds longer and then flew down at it, but failed to secure the butterfly, and rising, turned and again swooped down on the spot. This time it hovered for a few seconds while hunting for the butterfly, but the latter had evidently got well down under the grass, and the flycatcher returned to its perch discomfited": C. F. M. Swynnerton (letter dated 16, viii, 1907).—(*n*) "Mrs. Watt-Smyth told me that two or three weeks ago, when she was walking in the garden here [New Barnet] with my sister and cousin, they saw a flycatcher capture a white butterfly": C. F. M. Swynnerton (letter dated 19, viii, '07).—(*o*) "Spotted flycatchers seen on August 1st near Canterbury catching and eating meadow-brown butterfly": F. C. Snell, "Country-Side," 1907, p. 290.—(*p*) "On an Arabian burial ground, below Las Glacières Blida [in Algeria], I saw at noon a small brown bird (doubtless the grey flycatcher, which is plentiful there) catch a specimen of *Pieris rapae* on the wing": Dr. Karl Jordan (in a letter to Prof. Poulton, dated 21, ix, 1908).—(*q*) "A water wagtail [Dr. Longstaff informs me that this is an error, and that the bird was a grey

flycatcher] has this year built a nest in the *Ampelopsis veitchii* on my house at Putney. Miss C. A. Dixon was sitting in the garden on July 19 watching the bird go every few minutes to feed its young, and on one occasion noticed that it carried a white butterfly in its beak. On July 25 the same lady saw the bird snap at a white butterfly but miss it": Dr. G. B. Longstaff, "Ent. Mo. Mag.," 1904, p. 211.—(*r*) "On one other occasion the owner of that lawn saw a bird try to catch a butterfly. He was astonished to see more than one bird chasing what he took to be a small meadow-brown. At last a flycatcher knocked the insect to the ground almost at my friend's feet. He picked it up and found a white-letter hairstreak (*T. w-album*), a butterfly which he did not know was to be found in the neighbourhood": H. P. R., "Country Life," March 14, 1908, p. 384 (England).—(*s*) The flycatcher has been seen to chase, catch or eat common white butterflies by five correspondents: The Editor, "Country-Side," 1903, p. 290 (England).

25. *Muscicapa collaris*, Bechst. (White-collared Flycatcher). "It feeds on flies, gnats . . . butterflies and other insects on the wing": Naumann, "Vög. Deut.," ii, p. 329 (1822).
26. *Muscicapa atricapilla*, L. (Pied Flycatcher). "It also eats small grasshoppers, butterflies, etc., in times of scarcity, even worms": Naumann, *l. c.* p. 237.
27. *Muscicapa parva*, Bechst. (Red-breasted Flycatcher). "It feeds, like the other flycatchers, on flies, gnats, small butterflies and so forth": Naumann, *l. c.* p. 274.
28. *Hirundo rustica*, L. (Swallow). (*a*) "They subsist on a great number of genera and species of small insects, as flies, *Stomoxys* (Stechfliegen) . . . small Lepidoptera, as: Tineidae, Pyralidae, Tortricidae, Alucitidae, numerous small beetles and so forth; and in times of need they will also eat small butterflies (the larger ones are not eaten, as their wings are mostly too broad), small Noctuidae, and the smallest dragonflies": Naumann, *l. c.* vi, p. 61.—(*b*) "In the month of March during the northern migration of swallows, a small butterfly, *Thestor ballus* (one of the Lycaenidae), is out in great abundance on the plains. When walking across the grass, the swallows, which keep flying very close to the leeward of you, instantly

catch any unfortunate *ballus* that flies up; but they seem to be unable to take them on the ground, perhaps from the protective colouring of their green under-wings they cannot see them when at rest; but anyway the swallow is an annoyance to the butterfly collector": Lt.-Col. Irby, "Ornith. of the Straits of Gibraltar," p. 94 (1895, 2nd ed.).—(*c*) "In England I have noticed a swallow hunting one of the common 'Whites' (apparently *Pieris brassicae*)": R. Trimen, Proc. Ent. Soc. L., 1897, p. xci.—(*d*) "I have several times had opportunities of observing that white butterflies were captured on the wing by swallows": M. Spaeth, "Ill. Zeits. Ent.," 1899, p. 124 (Germany). —(*e*) "A good many years ago I released a large number of 'Camberwell Beauties' (Trauermäntel). The Swallows collected in a row in front of the window in order to snap up the butterflies. I do not believe that 20 per cent. of the latter reached the adjoining wood, towards which they all directed their course. The same thing happened in the case of some 'Purple Emperors' (Schillerfaltern) a few years later. 'Tortoiseshells' (Füchse) and 'Peacocks' (Tagpfau) were entirely unmolested by swallows . . . *Melitaea* and *Argynnis* were taken": W. Caspari, Soc. Ent. Zurich, xvi, p. 34.—(*f*) Observed to capture *Lycaena argiolus* on the wing: Prof. E. B. Poulton, "Nature," lxv, 1902, p. 343.—(*g*) "Mr. W. Holland tells me that about the middle of June 1901 he saw a swallow swoop down from a great distance and catch a white butterfly (almost certainly *Pieris rapae*) flying in front of the [Oxford] Museum": Prof. Poulton, *l. c.*—(*h*) "Further, I have often seen birds catch butterflies in Hongkong, Cochin China and Europe, but neither birds nor butterflies were identified. The birds were in many cases swallows": Dr. F. Doflein (in a letter dated 12, iv, 1907).—(*i*) "Mortehoe, N. Devon. W. Bonner saw a swallow 'spike and carry off' a brown butterfly (he thinks *H. janira*). Aug. 23, 1894. Reported to me the same day": Dr. F. A. Dixey (*in litt.*).—(*j*) "On the afternoon of July 7, 1901, H. G. Dixey kicked up a specimen of *H. janira* in the Parks, Oxford. As it rose it was taken by a swallow. This was seen by J. Dixey, H. G. Dixey and R. N. Dixey, and reported

to me the same day": Dr. F. A Dixey (*in litt.*).—(*k*) "I have seen butterflies attacked by the Barn Swallow (*H. rustica*) and the Swift—*P. rapae* in both cases": W. Parkinson Curtis (letter to Prof. Poulton, 22, ix, '05).—(*l*) A swallow was observed to capture a *Colias edusa:* W. Buckler, "Ent. Mo. Mag.," July 1877, p. 40.—(*m*) "Some years ago I saw a swallow trying to seize a red admiral flying": G. E. Johnson, "Country-Side," 1907, p. 141 (England).—(*n*) The swallow has been observed to chase, catch or eat common white butterflies by four correspondents; "two readers have seen the swallow take meadow-browns (Mr. J. Higgs, of Maryborough, noting seven specimens taken in seven minutes), and one each have noticed the capture of a peacock butterfly, a painted lady and a tortoiseshell": The Editor, "Country-Side," 1903, p. 290 (England).

29. *Cypselus apus*, L. (Swift). (*a*) "All sorts of beetles, gadflies, butterflies and moths, . . . serve to fill its rapidly digesting, and therefore always hungry, stomach": Naumann, "Vög. Deut.," vi, p. 130.—(*b*) Cf. *Hirundo rustica* (*k*).

30. *Caprimulgus europaeus*, L. (Nightjar). "And further the flower-beetles, dragonflies, butterflies and Diptera, which sit at rest in the evenings, do not escape it": Naumann, *l. c.* vi, p. 153.

31. *Merops apiaster*, L. (Bee-Eater). Prof. Kathariner records that on May 6, 1895, at Angora in Asia Minor, the butterfly *Thais cerisyi* was flying in great numbers, when suddenly a swarm of Bee-Eaters appeared, and "without paying any attention to me, began to make a terrible clearance among the butterflies. One heard continuously the snapping of their beaks, and in the shortest space of time there was not a butterfly to be seen. Those that were not eaten had hidden under the herbage": L. Kathariner, "Biol. Centralb.," xviii, 1898, p. 681.

32. *Cuculus canorus*, L. (Cuckoo). (*a*) An example of *Aporia crataegi* found in the stomach of one bird: E. Csiki, "Aquila," xi, 1904, p. 309.—(*b*) "Although its principal food consists of caterpillars, yet it often takes both butterflies and moths, and even lepidopterous pupae and eggs are not despised": J. A. Link, "Mon. Deut. Ver. Schutze Vög.," 1889, p. 439.

33. *Falco tinnunculus*, L. (Kestrel). (*a*) This bird was seen (near Swanage, Dorset) to capture numerous butterflies (*Argynnis aglaia* and *Melanargia galatea*) by pouncing on them when settled on the ground. The observer "found by counting that the bird caught about thirty-six specimens in an hour, and it was hard at it for at least five hours": W. Parkinson Curtis, "Entomol.," 1903, p. 68.—(*b*) "I would say that my note on the Kestrel in the 'Entomologist' in 1903 has been confirmed by repeated observations at the same place, and presumably on the same pair of birds every year since. In July 1904 I was a month at Swanage and was at least a dozen times on the Down in daylight, when the Kestrel was at its old game of slaughtering *Argynnis aglaia* and *M. galatea*. Last season (July 1905) *aglaia* was scarce and the attacks were confined almost wholly to *semele* and *galatea;* at least, the wings I saw mostly belonged to those species": W. Parkinson Curtis (letter to Prof. Poulton, 22, iv, '05).—(*c*) I have recently received several further communications from Mr. Parkinson Curtis with regard to his extremely interesting and valuable observations on the feeding habits of the Kestrel. On Aug. 8, 1907, he wrote: "On August 3 I had to go near the Ballard Down, so walked to the place where I had generally seen the Kestrel; it was doing precisely the same thing as I have previously recorded and at about the same average rate." On Sept. 2 he wrote: "On Sept. 1st I was collecting on Studland Hill and Nine Barrow Down, that is about 2½ miles from the Kestrels I have sent you a note about. I saw three Kestrels catching butterflies; they were at it, off and on, from 11.30 a.m. to 3.45 p.m., but I could not get near enough to see what they were catching. That they were catching butterflies, all three, I am certain from the manner of hawking, and their movements on the ground; but there was no cover for me to approach them, so I cannot give you any precise details, except one female *semele* which I put up and which flew in the direction of one Kestrel and was promptly captured." In reply to inquiries, Mr. Curtis informed me that Pierines of all kinds were very scarce on the Downs frequented by the Kestrel, and he had not actually seen any

attacked. Lycaenidae, Hesperiidae and *Coenonympha* he considered to be too small for the Kestrels, and he had only on one occasion observed the capture of a female *Hesperia actaeon*.—(*d*) "At Beachy Head in the past summer and in 1906 I watched a Kestrel feeding on this species [*Polyommatus corydon*]. It hovered just over the grass stems and picked them off one after the other while at rest": C. W. Colthrup, "Country-Side," 1908, p. 267.

34. *Falco subbuteo*, L. (Hobby). The stomach of a specimen contained "the body of a small Locustid, a middle-sized butterfly and about 120 brownish-black ants (*Formica fusca*, L.)": Prof. Salzmann, "Mon. Deutsch Ver. Schutz Vög.," 1906, p. 511.

35. Birds not identified:—

(*a*) A bird captured and ate a specimen of *Argynnis adippe*: Colthrup, "Entom." 1903, p. 173 (England). —(*b*) "During many years of entomological work I have on only ten occasions actually observed birds pursuing species of *Vanessa* or *Pieris* under natural conditions": C. Frings, "Soc. Ent. Zurich," xv, 1900, p. 76.—(*c*) "I have frequently seen birds catch and devour the unprotected species [of butterflies] on the wing": A. G. Butler, "Nature," iii, 1870, p. 166 (England).—(*d*) "In this country it was not an uncommon sight to see the *Pontiae* pursued by birds, and sometimes escaping by means of their tortuous or dodging flight": H. W. Bates, Proc. Ent. Soc. L., 1864 (3), ii, p. 22 (England).—(*e*) "Evidence of the attacks of birds was supplied by Mr. Fred Birch in a specimen of *Thecla quercus* from Lancashire (August 1898). A bird was seen to dart at the spot where the butterfly was settled, and the insect, when captured, exhibited symmetrical injuries, such as would be caused by a snip taken out of both wings when in contact in the position of rest": Prof. E. B. Poulton, "Oxford Univ. Gazette," 1905, p. 566.—(*f*) "No one has been able to adduce any examples of a bird eating a butterfly, beyond a few cases where the food was either the 'meadow-brown or large heath (*E. janira* or *E. tithonus*), or the green hairstreak'—out of thousands of observers, entomologists and ornithologists": H. P. R., "Country Life," March 14, 1908, p. 384. [The evidence here collected sufficiently demonstrates

the inaccuracy of this dogmatic statement.—G. A. K. M.]—(*g*) "My assistant Dr. Kuhn saw a small bird (?) seize a *Vanessa C-album* on the wing" (Freiburg im Breisgau): Prof. Aug. Weismann (letter to Prof. Poulton, dated 14, ii, 1909).

The following list gives a summary of those butterflies which have been exactly or approximately identified, together with the birds which have pursued or eaten them—

PALAEARCTIC BUTTERFLIES.

SATYRINAE.

Melanargia galatea, L.—Falco tinnunculus (33, *a*, *b*).
Epinephele janira, L.—Passer domesticus (4, *b*, *q*); Acrocephalus schaenobaenus (15); Muscicapa grisola (24, *k*, *l*, *o*); Hirundo rustica (28, *i*, *j*, *n*).
E. tithonus, L.—Bird (35, *f*).
E. jurtina, L.—Muscicapa grisola (24, *e*).
Hipparchia semele, L.—Falco tinnunculus (33, *b*, *c*).
Pararge egeria, L.—Musc. grisola (24, *b*).

NYMPHALINAE.

Argynnis sp.—Passer domesticus (4, *q*).
A. adippe, L.—Passer domesticus (4, *c*); Bird (35, *a*).
A. aglaia, L.—Falco tinnunculus (33, *a*, *b*).
Melitaea sp.—Hirundo rustica (28, *c*).
Pyrameis atalanta, L.—Erithacus rubecula (12, *b*); Hirundo rustica (28, *m*).
P. cardui, L.—Hirundo rustica (28, *n*).
Vanessa io, L.—Passer domesticus (4, *p*); Phoenicurus phoenicurus (10, *e*); Hirundo rustica (28, *n*).
V. antiopa, L.—Acanthis cannabina (5); Hirundo rustica (28, *e*).
V. polychloros, L.—Passer domesticus (4, *h*, *l*).
V. urticae, L.—Passer domesticus (4, *a*, *d*, *n*, *q*); Motacilla, sp. (8, *a*); Phoenicurus phoenicurus (10, *e*): Sylvia hortensis (16); Troglodytes troglodytes (20); Muscicapa grisola (24, *i*); Hirundo rustica (28, *n*).
Polygonia C-album, L.—Passer domesticus (4, *f*); Bird (35, *g*).
Vanessidi.—Pass. domesticus (4, *g*); Phoenicurus phoenicurus (10, *d*); Bird (25, *b*).
Apatura iris, L.—Hirundo rustica (28, *e*).

Lycaeninae.

Polyommatus icarus, Rott.—Passer domesticus (4, *q*).
P. corydon, Poda.—Falco tinnunculus (33, *d*); Pratincola rubetra (9).
Cyaniris argiolus, L.—Hirundo rustica (28, *f*).
Thestor ballus. F.—H. rustica (28, *b*).
Callophrys rubi, L.—Bird (35, *f*).
Thecla quercûs, L.—Bird (35, *e*).
T. w-album, Knoch.—Muscicapa grisola (24, *r*).
Lycaeninae.—Erithacus rubecula (12, *d*).

Pierinae.

Aporia crataegi, L.—Cuculus canorus (32, *a*).
Pieris spp.—Corvus monedula (1); Sturnus vulgaris (2, *b*); Passer domesticus (4, *k*, *q*, *r*); Parus sp. (6, *b*); Motacilla sp. (8, *b*); Phoenicurus phoenicurus (10, *c*); Erithacus rubecula (12, *d*); Turdus viscivorus (13); Phylloscopus trochilus (18); Muscicapa grisola (24, *f*, *g*, *h*, *n*, *q*, *s*); Hirundo rustica (28, *d*, *n*); Bird (35, *b*, *d*).
P. rapae, L.—Passer domesticus (4, *a*, *i*, *j*, *m*); Parus major (7); Accentor modularis (11); Acrocephalus schaenobaenus (15); Sylvia hortensis (16); Lanius collurio (23, *b*); Muscicapa grisola (24, *j*, *l*, *p*); Hirundo rustica (28, *g*, *k*); Cypselus apus (28, *k*).
P. brassicae, L.—Passer domesticus (4, *j*, *o*); Erithacus rubecula (12, *a*); Muscicapa grisola (24, *m*); Hirundo rustica (28, *c*).
Euchloë cardamines, L.—Erithacus rubecula (12, *c*).
Colias edusa, F.—Erithacus rubecula (12, *c*); Muscicapa grisola (24, *d*); Hirundo rustica (28, *l*).
Gonepteryx rhamni, L.—Passer domesticus (4, *q*).

Papilioninae.

Thais cerisyi, Godt.—Merops apiaster (31).
Parnassius apollo, L.—Sylvia hortensis (16).
P. mnemosyne, L.—Sylvia hortensis (16).
Papilio podalirius, L.—Lanius minor (21, *b*).

Records from the Ethiopian Region.

1. *Motacilla capensis*, L. (Cape Wagtail). (*a*) "I not only obtained an Arctiid moth (*Binna madagascariensis*), which I surprised one of these birds in the act of kill-

ing, but also saw another actually pursuing a butterfly belonging to the genus *Acraea*": W. L. Distant, "Naturalist in the Transvaal," p. 70.—(*b*) Seen to "take moths and *P.* [*Pieris*] *hellica*": J. P. Mansel Weale, "Nature," iii, p. 508 (Cape Colony).

2 *Motacilla* sp. (Wagtail). Prof. Yngve Sjöstedt, of Stockholm, informs me that although he paid no special attention to this subject, he well remembers to have observed birds of this genus pursuing and capturing butterflies in the beds of rivers on the Cameroon Mountain in West Africa.

3. *Nectarinia* sp. (Sunbird). "Mrs. Barber informs me that *Pyrameis cardui* is a frequent victim among the butterflies with which the Sunbirds (*Nectariniae*) feed their young": R. Trimen, "S. Afr. Butterf.," i, p. 34, note (Cape Colony).

4. *Apalis thoracica*, Shaw (Bar-throated Warbler). On June 7, 1903, near Salisbury, Rhodesia, I myself saw one of those birds catch an *Acraea nohara-halali*, Mshl., which it ate with apparent relish.

5. *Pratincola torquata*, L. (South African Stonechat). "In March [1900] I saw a *Pratincola torquata* in chase of *Tarucus plinius*": C. F. M. Swynnerton, Trans. Ent. Soc. Lond., 1902, p. 358 (Gazaland).

6. *Lanius collaris*, L. (Fiskal Shrike). "At the Cape I have seen *Fiscus collaris*, the common shrike of the colony, seize in succession several *Papilio lyaeus* on the wing": R. Trimen, Proc. Ent. Soc., 1897, p. xci.

7. *Bradyornis mariquensis*, Sm. (Marico Wood-Shrike). "Feb. 27, 1898. Saw a Marico wood-shrike dart down from a tree and catch a *Sarangesa eliminata*, Holl., which was sitting with outspread wings on a small plant": G. A. K. Marshall, Tr. Ent. Soc. 1902, p. 357 (Rhodesia).

8. *Pachyprora molitor*, Hahn and K. (White-flanked Flycatcher). (*a*) "March 6, 1898. Saw a flycatcher (*Pachyprora molitor*) make several futile attempts to catch a *Tarucus plinius*, which was circling round the bush on which it sat." G. A. K. Marshall, *l. c.* p. 357 (Rhodesia).—(*b*) On June 7, 1903, near Salisbury, Rhodesia, I saw one of these birds eat a small Lycaenid (probably *Tarucus telicanus*) and a small Hesperid (probably *Baoris detecta*).

9. *Trochocercus albonotatus*, Sharpe (White-spotted Fly-

catcher). "On April 3 one of these birds was seen by Odendaal to dart out from the trees at the edge of Chirinda at a butterfly (*Mylothris*) flying past a few feet away, but to turn back on reaching it without an attempt at capture": C. F. M. Swynnerton, "Ibis," 1908, p. 98 (Mashonaland).

10. *Terpsiphone perspicillata* Sw. (S. African Paradise Flycatcher). (*a*) "I have seen *Tchitrea cristata* darting at *P.* [*Mylothris*] *agathina*": J. P. Mansel Weale, "Nature," iii, p. 508 (Cape Colony).—(*b*) "I would notice that I have seen a *Tchitrea cristata* capture a [*Papilio*] *merope* ♂, and chase a *P. nireus*, and I have little doubt that this bird is most destructive to bush-frequenting Rhopalocera": J. P. Mansel Weale, Proc. Ent. Soc., 1874, p. 132 (Cape Colony).—(*c*) "March 28, 1897. While out collecting at Malvern, Durban, Natal, I saw a Paradise Flycatcher catch a specimen of *Eronia cleodora*": G. A. K. Marshall, Trans. Ent. Soc., 1902, p. 357.—(*d*) "While watching an *Atella phalantha* hovering over a bush of its food-plant, a Paradise Flycatcher darted past, and with a loud snap of its beak, tried to catch the butterfly in its swoop:" G. A. K. Marshall, *l. c.* (Rhodesia).

11. *Dicrurus afer*, Licht. (African Drongo). (*a*) "I have little doubt that . . . *Dicrurus musicus*, Vieill., is most destructive to bush-frequenting Rhopalocera": J. P. Mansel Weale, Proc. Ent. Soc. 1874, p. 132 (Cape Colony).—(*b*) "December 1, 1898. C. F. M. Swynnerton saw a drongo (*Buchanga assimilis*) fly past him with a white butterfly in its beak, probably *C. florella*": G. A. K. Marshall, *l. c.* p. 357 (Rhodesia).—(*c*) A drongo observed to attack a tattered *Belenois* (either *mesentina* or *severina*): G. A. K. Marshall, *l. c.* p. 357 (Rhodesia).—(*d*) "Gorongoza Dist., Portuguese E. Africa, May 1907. Although this species was common, I only once noticed it take butterflies, when one caught a small brown species that was passing where it was perched": C. H. B. Grant (note from diary).—(*e*) "I have on several occasions seen the common Drongo (*D. afer*) make more or less successful darts at passing butterflies" (N.E. Rhodesia): S. A. Neave (letter dated 19, ii, 1909).

12. *Dicrurus* sp. (Drongo). Colonel N. Manders tells me that in the harbour of Nossi Be, Madagascar, in 1907,

he observed a drongo pursuing a butterfly (*Hypolimnas drucei*, Butl.) which it failed to capture.

13. *Dicrurus ludwigi*, Smith (Lesser Drongo). "16, viii, 1908. In the same locality as yesterday, viz., the edge of a patch of dense forest, saw a Lesser Drongo (*D. ludwigii*), catch a damaged *Catopsilia florella*": S. A. Neave (note from diary; N.E. of Lake Bangweolo).
14. *Hirundo monteiri*, Hartl. (Monteiro's Swallow). "13, vi, 1908. N.E. of Lake Bangweolo. Saw a large swallow, probably *H. monteiri*, capture a *Teracolus ? evenina* which appeared to have been previously injured": S. A. Neave (note from diary).
15. *Hirundo* sp. (Swallow). "I think I told you long ago of having found the wings of a lot of butterflies, chiefly *P. corinneus*, below the branch of a tree on which some swallows were constantly settling": C. F. M. Swynnerton, Tr. Ent. Soc., 1902, p. 358 (Gazaland).
16. *Cypselus caffer*, Licht. (S. African Swift). Observed to "take small moths from the grass and dart at *Terias rahel* [*brigitta*, Cram.] on our open flats": J. P. Mansel Weale, "Nature," iii, p. 508. (Cape Colony.)
17. *Dicrocercus hirundineus*, Licht. (Swallow-tailed Bee-Eater). "11, x, '07. I watched to-day for about half-an-hour a specimen of the Swallow-tailed Bee-Eater (*D. hirundineus*) hawking butterflies. As far as I could see he took nothing but Pierines, *C.* [*Catopsilia*] *florella* mostly, but one or two *B.* [*Belenois*] nr. *dentigera*, and one *Terias*" (N.W. Rhodesia): S. A. Neave (in a letter to Prof. Poulton).
18. *Merops persicus*, Pall. (Blue-cheeked Bee-Eater). (*a*) "In the vicinity of every hole were numbers of pellets, formed of the wings and other indigestible parts of dragon-flies, butterflies, beetles, etc.": S. Stafford Allen, "Ibis," 1862, p. 359 (On the Nile).—(*b*) Mr. C. F. M. Swynnerton has recently sent me a butterfly which was taken from the stomach of one of these birds at Chibababa, Portuguese E. Africa, on December 11, 1906. The insect is an *Acraea*, belonging to the group represented by *A. horta*, L., but is too much damaged for exact identification. The same gentleman notes the dexterity of these birds in catching insects, but states: "Yet I saw one strike

deliberately at a *Bclenois* (of which the rapid erratic flight must be very puzzling to a bird) and miss it. I have noticed the same difficulty on the part of *Dicrurus afer*" ("Ibis," 1908, p. 398).

19. *Merops apiaster*, L. (European Bee-Eater). (*a*) I have recently received from Mr. C. F. M. Swynnerton the two front wings of an Hesperid (either a *Baoris* or *Platylesches*), which were taken from a stomach of this bird near Chirinda (3500 ft.), Gazaland, on March 26, 1907.—(*b*) "I have found a specimen of *Mylothris agathina* in the crop of the common 'Abelharuco' (*Merops apiaster*)": Dr. F. Creighton Wellmann, "Ann. Soc. Ent. Belg.," 1908, p. 148 (Angola).
20. *Merops nubicoides*, Desm. and P. (Carmine-throated Bee-Eater). Mr. C. H. B. Grant has kindly supplied me with the two following observations noted in his diary when in S.E. Africa.—(*a*) "Near Beira (Jan. 1907) I saw three of these birds together perched on the top of a dead tree, and when walking up to shoot them I distinctly saw one fly out and take a brown butterfly that was passing."—(*b*) "When travelling up the Zambesi from Tambara to Tette (Aug. 1907), a small flock of these birds was hawking over the water, and twice or three times I saw them catch white butterflies, of which there were quite a number about."
21. *Merops sp.* "All kinds of insects form the prey of these birds. Once I shot one with its mouth so stuffed with butterflies that it appeared to me marvellous that it had not choked": Capt. Boyd Alexander, "From the Niger to the Nile," vol. ii, p. 29 (N. Nigeria). [The bird was doubtless collecting food for its young, G. A. K. M.]
22. *Merops boehmi*, Reichen. (Böhm's Bee-Eater). "15, viii, 1908. Saw a Böehm's Bee-Eater make one or two attempts to catch butterflies, chiefly Pierines, but did not see him actually take one": S. A. Neave (note from diary; N.E. of Lake Bangweolo).
25. *Melittophagus meridionalis*, Sharpe (Little Bee-Eater).—(*a*) "I noticed one bird catch a white butterfly, but small coleopterous insects seem to form the chief part of their prey." Dr. A. Stark, in Stark and Sclater's "Birds of S. Africa," iii, p. 69 (Natal).—(*b*) Mr. Swynnerton has sent me the stomach of one of these birds which he shot in Melsetter District,

Mashonaland, in October 1906. This contained two flies of the genus *Pyrgota* and one of the genus *Sarcophaga*, one beetle (*Onthophagus aeruginosus*, Roth.) and one butterfly (*Precis* sp.), far too much damaged for exact identification.—(*c*) "Luombwa R., near S.E. boundary of the Congo Free State. 13, xii, 1907. Saw a little Bee-Eater (*M. meridionalis*) catch and eat what appeared to be *Atella phalantha*, though it may possibly have been its mimic *Pseudargynnis hegemone*, as they are impossible to distinguish on the wing": S. A. Neave (note from Diary).—(*d*) "Besides the above I have on several occasions seen *M. meridionalis* make more or less successful darts at passing butterflies": S. A. Neave (letter dated 19, ii, 1909).

24. *Melittophagus bullockoides*, Smith (White-fronted Bee-Eater). At Chibababa, in Portuguese E. Africa, Mr. Swynnerton watched these birds hawking insects. "During the whole time that I was watching, perhaps a quarter of an hour, I saw the birds fly out six times after butterflies of some size, including Pierines, probably *Catopsilia florella* and *Belenois severina* or *B. mesentina*, as these seemed to be the only white butterflies which were flying over the water. In these six attempts the butterfly was caught outright only twice; on two other occasions, after much dodging, it got away and the bird returned to its perch; while on two remaining occasions, on one bird missing the insect, several others promptly flew out (the first time seven or eight, and the second time three) to join in the sport, the butterfly being eventually captured, each time after some little darting about and confusion. Besides this, on quite a number of occasions, I saw a bird aim at or catch what I took to be a Lycaenid, the others going out to its aid in the same manner three or four times": C. F. M. Swynnerton, "Ibis," 1908, p. 399. [He shot one bird and sent me the stomach, which contained a specimen of *Acraea rabbiae*, Ward, G. A. K. M.]

25 *Eurystomus afer*, Lath. (Yellow-billed Roller). "Masembeti, near Beira, Nov. 1906. This bird was sitting on a very tall dead tree, and I saw it take a large reddish or brown butterfly on the wing": C. H. B. Grant (note from diary).

26. *Coracias caudatus*, L. (Lilac-breasted Roller). "Rollers (*Coracias caudata*) are great hawkers of flying insects, especially of butterflies": H. A. Bryden, "Nature and Sport in S. Africa," p. 64.
27. *Coracias* sp. "I may here say that I have on one occasion seen a Roller (*Coracias*) in West Africa capture on the wing a Pierine, probably *Terias senegalensis*": Dr. F. Creighton Wellman, "Ann. Soc. Ent. Belg.," 1908, p. 148.
28. *Ispidina natalensis*, Smith (Natal Kingfisher). "These birds feed entirely on butterflies and insects caught on the wing": T. Ayres, in Sharpe's "Monogr. Kingfishers," p. 146 (Natal).
29. *Halcyon chalicuti*, Stanley (Striped Kingfisher). (*a*) "Its food consists entirely of Coleoptera, Orthoptera, Lepidoptera and flies. . . . It captures insects on the wing": von Heuglin, quoted in Sharpe's "Monogr. Kingfishers," p. 184 (N.E. Africa).—(*b*) "Nov. 23, 1908. "Saw a Bush Kingfisher catch and eat two butterflies, viz. *Junonia cebrene* and *Catopsilia florella*, both of which were captured when feeding." G. A. K. Marshall, Tr. Ent. Soc., 1902, p. 357 (Rhodesia).
30. *Coccystes cafer*, Licht. (Levaillant's Cuckoo). "Dec. 15, 1898. Remains of *Papilio demodocus* found in the stomach of a cuckoo (*Coccystes cafer*)": G. A. K. Marshall, *l. c.* (Rhodesia).
31. *Falco subbuteo*, L. (Hobby), "Swynnerton shot a hobby which had in its stomach an almost complete *Terias*": G. A. K. Marshall, *l. c.* (Rhodesia).
32. Birds not identified:—
(*a*) "Empandeni, Plumtree, Rhodesia. On Feb. 31 of this year (1907) I was passing through a native field and saw a brownish bird about the size of a starling dart out of a tree and seize a *Pieris* or *Teracolus* (I could not be certain which, as the butterfly was flying rather high and I was not near enough to identify it) in its beak and fly back to the tree with it. I was near enough to be absolutely certain of this. It was the first time I had ever witnessed anything of the sort, and so far I have not seen a repetition of any such attack": Father O'Niel, S. J. (*in litt.*).—(*b*) "This *Salamis* was settled on the under-side of a leaf when a bird made a dart at it and took the piece out of the wings. May 12, 1902, Stella Bush, Dur-

ban": note by F. Muir on a specimen of *S. anacardii* (= *parhassus*, Drury) in the Oxford Museum. Prof. Poulton, to whom I am indebted for this record, says, that a huge piece, probably over one-third, is taken symmetrically out of both hind-wings.—(*c*) "I have only once seen a bird attempt the capture of a butterfly, and that was a shrike, which is common here, trying to catch a newly emerged *Charaxes*": Rev. K. St. Aubyn Rogers, in a letter to Prof. Poulton dated Taveta, B. E. Africa, July 5, 1905.—(*d*) "On May 18, 1908 [at Durban, Natal], I followed up a ♀ *Charaxes neanthes* and obtained eighteen ova, and should have got more, but the fly was then captured by a bird." G. F. Leigh (in a letter to Prof. Poulton, dated 12, ix, 1908).—(*e*) Mr. F. Muir "expressed surprise that any doubts should have been raised. He had frequently observed such attacks at Delagoa Bay and other places on the East Coast of Africa, and had seen birds waiting in trees or bushes and darting out at butterflies as they approached": Prof. E. B. Poulton, "Essays on Evolution," p. 282, note.

The following is a summary of the butterflies attacked :—

ETHIOPIAN BUTTERFLIES.

ACRAEINAE.

Acraea sp.—Motacilla capensis (1, *a*); Merops persicus (18, *b*).
A. rabbaiae, Ward.—Melittophagus bullockoides (24).
A. nohara-halali, Mshl.—Apalis thoracica (4).

NYMPHALINAE.

Atella phalantha, Drury.—Terpsiphone perspicillata (10, *d*): Melittophagus meridionalis (23, *e*).
Pyrameis cardui, *L.*—Nectarinia sp. (3).
Precis sp.—Melittoph. meridionalis (23, *b*).
P. hierta-cebrene, Trim.—Halcyon chelicuti (29, *b*).
Salamis parhassus, Drury.—Bird (32, *b*).
Hypolimnas dubius-druceï, Butl.—Dicrurus sp. (12).
Charaxes sp.—Bird (32, *c*).
C. neanthes, Hew.—Bird (32 *d*).

LYCAENINAE.

Tarucus telicanus, Lang.—Pratincola torquata (5); Pachypora molitor (8, *a*, *b*).

Pierinae.

Mylothris sp.—Trochocercus albonotatus (9; butterfly refused).
M. agathina, Cram.—Terpsiphone perspicillata (10, *a*); Merops apiaster (19, *b*).
Belenois spp.—Merops persicus (18, *b*); Dicrurus afer (11, *c*).
B. near *dentigera*, Butl.—Dicrocercus hirundineus (17).
Synehloe helice, L.—Motacilla capensis (1, *b*).
Eronia cleodora, Hübn.—Terpsiphone perspicillata (10, *c*).
Catopsilia florella, F.—Dicrurus afer (11, *b*); Dicrurus ludwigi (13); Dicrocercus hirundineus (17); Halcyon chelicuti (29, *b*).
Teracolus ? evenina, Wallg.—Hirundo monteiri (14).
Terias sp.—Dicrocercus hirundineus (17); Falco subbuteo (31).
T. brigitta, Cram.—Cypselus caffer (16).
T. senegalensis, Boisd.—Coracias sp. (27).
Pierinae.—Merops nubicoides (20, *b*); Merops boehmi (22); Melittophagus meridionalis (23, *a*); M. bullockoides (24); Bird (32, *a*).

Papilioninae.

Papilio demodocus, Esp.—Coccystes cafer (30).
P. dardanus-cenea, Stoll.—Terpsiphone perspicillata (10, *b*).
P. niveus-lyacus, Doubl.—Lanius collaris (6); Terps. perspicillata (10, *b*).
P. pylades-angolanus, Goeze.—Hirundo sp. (15).

Hesperiidae.

Sarangesa eliminata, Holl.—Bradyornis mariquensis (7).
Baoris detecta, Trim.—Pachyprora molitor (8, *b*).
Hesperiidae.—Merops apiaster (19, *a*).

Records from the Indo-Malayan Region.

1. *Copsychus saularis*, L. (Dhayal Bird). "I remember once seeing at Dehra Dun a Dhyal or Magpie-Robin take a disabled *Catopsilia* I threw out for it": Frank Finn, "Nature," lxi, 1899, p. 55 (India).
2. *Pycnonotus* sp. (Bulbul). "The Hon. Mr. Justice Newton, who assiduously collected and took notes

upon the Lepidoptera of Bombay, informed me that the *Charaxes psaphon* of Westwood was continuously persecuted by the Bulbul": A. G. Butler, "Nature," iii, 1870, p. 165, note.

3. *Pycnonotus sinensis*, Gm. (Green Bulbul). Observed to attack butterflies in Southern China, "but generally miss them": J. C. Kershaw, Tr. Ent. Soc. Lond. 1905, p. 6.
4. *Otocampsa fuscicaudata*, Gould (Red-whiskered Bulbul). "This afternoon I was sitting under the veranda with my head within about 5 ft. of a red-whiskered bulbul's nest containing two young birds about five days old. One of the parent birds arrived with the very last butterfly I should have expected it to have any dealings with, viz. *Acraea violae* . . . I noticed that the butterfly was well in the bird's bill, firmly held, with the wings in considerable disarray. The body must have been fairly well crushed, so that the bulbul must have been fully alive to the flavour. I put my head within about 3 ft. of the nest to see how the young birds took it. The bird went down and pushed the butterfly well into the youngster's throat, and it was swallowed immediately, wings and all, and the young bird settled quietly down without seeming in the slightest degree upset": H. L. Andrewes (in a letter to Prof. Poulton, dated 19, iii, '08, Nilgiri Hills, S. India).
5. *Artamus monachus*, Bp. (Swallow-Shrike). "It feeds on insects, butterflies on the wing, grasshoppers, etc. (Meyer)": Meyer and Wigglesworth, "Birds of Celebes," ii, p. 435.
6. *Artamus fuscus*, Vieill. (Ashy Swallow-Shrike). "I am not certain as to the date on which I saw the Ashy Swallow-Shrike catching specimens of the Euploea, *Crastia core*. . . . At least six specimens of the *Crastia* were captured by the shrike, all of which it carried away to a branch high up in a big tree, but I could not see whether they were eaten": Col. J. W. Yerbury, Tr. Ent. Soc. Lond., 1902, p. 360.
7. *Tephrodornis pondicerianus*, Gm. (Indian Wood-Shrike). "Moths and small butterflies form a considerable portion of its food": Capt. Legge, "Birds of Ceylon," ii, p. 374.
8. *Chibia hottentotta*, L. (Hair-crested Drongo). "Salween

River, 17, v, 78. . . . This tree [*Bombax malabaricum*] was in flower and was crowded with birds of all kinds, chiefly mainas, kingcrows and parrots. I noticed among them two or three hair-crested Drongos (*Chibia hottentotta*), and was rather surprised to see one of these suddenly dart from the tree and give chase to a white butterfly (*Appias hippo*) that was flitting about some willow-like bushes. The bird swooped at the butterfly several times and chased it, but so far as I could see did not succeed in catching it": Lt.-Col. C. T. Bingham, note from diary (Burma).

9. *Dicrurus ater*, Herm. (King-Crow).—(*a*) "It feeds . . . occasionally on moths and butterflies": Jerdon, "Birds of India," i, p. 428.—(*b*) "Delhi, 11, vii, 75. . . . While I was watching a *Papilo crithonius* [= *demoleus*, L.] flew past and the King-Crow gave chase, snapped at it, but the butterfly dodged, the bird twisted, and after making two or three more attempts caught it and flew with it to a small keekur tree (*Acacia*). For some time the King-Crow sat holding the butterfly, then he began to champ it and seemed to make two or three attempts at swallowing. A villager, however, coming through the grass close past the tree frightened the bird and it dropped the butterfly. I picked the insect up, but though still alive it was much injured and unable to fly": Lt.-Col. C. T. Bingham (note from diary).—(*c*) This bird was observed to catch butterflies in India: Major Nurse, "Journ. Bombay, N. H. Soc.," ix, 1895, p. 337.—(*d*) The common King-Crow (*Dicrurus ater*, I believe) invariably captures butterflies on the wing; I have seen these birds scores of times do this. Their usual prey seems to be a small deep yellow butterfly with black on the tip of the wings, but I have occasionally seen other butterflies so captured by them. . . . With reference to my previous letter I would say that the butterfly referred to was the *Terias silhetana* or *Terias laeta*, probably both": A. E. Mackay, "Nature," lxv, 1902, pp. 247 and 486 (India).—(*e*) "In the other case the butterfly, *Euthalia garuda*, had been slightly crippled by some accident, which a King-Crow detected at once, but it had some trouble to catch it": E. H. Aitken, "J. Bomb. N. H. Soc.," xvi, 1904, p. 156 (India).—(*f*) Observed to attack butterflies in Southern China, but generally

miss them: J. C. Kershaw, Tr. Ent. Soc., 1905, p. 6.—(*g*) "Sept. 23, 1885. Road up Thundiani, near Kala Pani Bungalow. Saw a young King-Crow, *Dicrurus ater*, stoop at a big blue *Papilio*, either *P. polyctor* or *P. arcturus*, and miss it. The bird did not repeat the attempt": Col. J. W. Yerbury, Tr. Ent. Soc., 1902, p. 359.—(*h*) "Sept. 2, 1886. Road up Thundiani, near top of the hill. Saw a young King-Crow stoop at a specimen of *Vanessa kaschmirensis*, and after missing it once take it at the second attempt. Did not notice whether the insect was eaten": Col. Yerbury, *l. c.*—(*i*) "Going through some fairly open jungle [in Burma] close to the main road I put up a *Melanitis zitenius*, which fluttered across the road and was swooped at by a King-Crow (*Dicrurus*), but missed": Lt.-Col. C. T. Bingham, Tr. Ent. Soc., 1902, p. 363.—(*j*) Observed to hawk *Catopsilia* in Burma: Lt.-Col. Bingham, *l. c.* p. 363.

10. *Dicrurus* sp. (Drongo). "On a forest path a *Danaus septentrionalis* flew along before me with its slow, flapping motion, when suddenly an apparently young Dicrurid—these birds are bitter enemies of butterflies—darted at it from a twig where it had been on the watch, but when about two feet away shook itself and then, without seizing the insect, returned to its perch": E. Haase, "Res. on Mimicry," p. 99 (Siam).
11. *Dicrurus longicaudatus*, Jerd. (Long-tailed Drongo). This bird was observed to seize a large butterfly (*Teinopalpus imperialis*, Hope) on the wing: G. C. Dudgeon, "J. Bomb., N. H. Soc.," ix, 1895, p. 337 (India).
12. *Dicrurus leucopygialis*, Blyth (White-vented Drongo). "Mr. Lewis also gives *Buchanga leucopygialis* as a very active hunter of butterflies on the wing": R. Trimen, Proc. Ent. Soc., 1897, p. xci (Ceylon).
13. *Dicrurus* sp. On two occasions in Java an "*Edolius*? sp." was seen to eat a *Euploea rafflesii*, Moore (Piepers): A. S. Packard, "Proc. Am. Phil. Soc.," 1904, p. 412.
14. *Buchanga* sp. (Drongo). "*Buchana* [sic] sp., a small species, was very common on a small island near Bangkok during the flying season of the *Catopsiliae*, and I have observed it as it was busy in capturing these insects." Haase also states that Dicruridae in general "appear to be special enemies of these

insects [butterflies]": E. Haase, "Researches on Mimicry," (transl.), ii, p. 101.

15. *Pericrocotus flammeus*, Forst. (Orange Minnivet). "Its diet consists of small butterflies and various winged insects, some of which it will occasionally take on the wing": Capt. Legge, "Birds of Ceylon," ii, p. 365.
16. *Terpsiphone princeps*, Temm. (Black-tailed Paradise Flycatcher). Observed to attack butterflies but generally miss them, in Southern China: J. C. Kershaw, Trans. Ent. Soc., 1905, p. 6.
17. *Terpsiphone paradisi*, L. (Indian Paradise Flycatcher). Observed to catch *Neptis aceris*, *Ixias marianne* and *Eurema* [*Terias*] *hecabe*, Jan. 1905, at Vavuniya Vilankulam, North Ceylon: Dr. F. Doflein (letter dated 12, iv, '07).
18. Flycatcher (not identified). "Often and often I have had opportunities of observing females of *Clerome faunula* fall a prey to flycatchers when sailing round the tops of trees with their slow fluttering flight": A. Grubauer, "Soc. Ent. Zurich," xvii, 1902, p. 123 (Malay Peninsula).
19. *Passer montanus*, L. (Tree Sparrow). (*a*) "Twice also have I seen a sparrow attack an *Amathusia phidippus*, L.": Piepers, quoted by Packard, "Proc. Am. Phil. Soc.," 1904, p. 412 (Java).—(*b*) "I have observed *Hesperia thrax* and other Hesperiidae and *Catopsiliae*, which were struck down and devoured by sparrows": E. Haase, "Researches on Mimicry" (transl.), ii, p. 101 (Siam).—(*c*) Observed to attack butterflies, but generally miss them, in Southern China: J. C. Kershaw, Trans. Ent. Soc. Lond., 1905, p. 6.—(*d*) "I have more than once noticed the common Burmese sparrow (*Passer montanus*) trying to catch some little moth. On one occasion I watched the insect, which had escaped, settle, and caught it. It proved to be a *Zizera* sp.?": Lt.-Col. C. T. Bingham (note from diary).
20. *Acridotheres tristis*, L. (Common Mynah). (*a*) "Kawkaraik, 18, iv, 1891. Saw a maina (*A. tristis*) while feeding on the ground in front of my bungalow make a sudden jump upwards to catch a passing *Papilio*; what species the latter was I did not see": Lt.-Col. C. T. Bingham (note from diary).—(*b*) "I may mention that not long ago I saw here in Calcutta a

Common Mynah with a white butterfly in its bill": F. Finn, "Nature," lxi, 1899, p. 55.

21. A Trogon (not identified). "The other day I saw a small Trogon dart at a *Terias* unsuccessfully": S. B. J. Skertchley, "Ann. Mag. N. H." (6) iii, 1889, p. 478 (Borneo).

22. *Merops viridis*, L. (Indian Bee-Eater). (*a*) Observed to catch butterflies in India: Major Nurse, "J. Bomb. Soc.," xv, p. 349.—(*b*) "Col. Swinhoe informs me that in India he has on several occasions seen *Merops viridis* catch and eat butterflies, and that he has also witnessed many cases of other birds pursuing them": R. Trimen, Proc. Ent. Soc. Lond., 1897, p. xc.—(*c*) "Mr. F. Lewis, of the Ceylon Forest Service, . . . has seen *Merops viridis* occasionally take small white and yellow butterflies (*Terias* spp.)": R. Trimen, *l. c.* xci.—(*d*) "In the cases [of birds attacking butterflies which] he had witnessed, the *Euploeae* and Danaidae were caught as often as any others, but usually escaped eventually from the beak of the bird and flew away none the worse owing to the toughness of the integuments. The only bird he had observed frequently to pursue butterflies was the Common Indian Bee-Eater, which he had seen hawking Pieridae, and among them *Teracolus*": Sir G. Hampson, Proc. Ent. Soc. Lond., 1897, p. xxxviii (India).—(*e*) "Another bird that frequently catches these butterflies [*Terias silhetana* and *T. lacta*] on the wing is the Indian Bee-Eater (*Merops viridis*)": A. E. Mackay, "Nature," lxv, 1902, p. 486 (India).—(*f*) "In one case a Bee-Eater caught a *Danais*, but dropped it as soon as it had tasted it, and the *Danais* flew away little the worse": E. H. Aitken, "J. Bomb. Soc.," xvi, 1904, p. 156 (India).—(*g*) *Terias hecabe* and *Papilio pammon* "seemed to be the principal victims of the graceful green Bee-Eaters. . . . They never missed their prey, and always brought their quarry back to the same spot to be dis-winged before being swallowed, the ground under their watch-towers being thickly strewn with gaily painted shreds of unfortunate butterflies and bees": E. L. Arnold, "On the Indian Hills," i, pp. 247, 248 (1881).—(*h*) Col. N. Manders informs me that in the year 1900 in Ceylon he observed a Bee-Eater of this species capture a *Charaxes psaphon*.

23. *Merops philippinus*, L. (Philippine Bee-Eater). (*a*) "Mr. F. Lewis, of the Ceylon Forest Service, . . . has seen *M. philippinus* occasionally take small white and yellow butterflies (*Terias* spp.)": R. Trimen, Proc. Ent. Soc. Lond., 1897, p. xci.—(*b*) "Frequently capture *Catopsiliae*, especially when these butterflies are travelling in thousands along the river-valleys" (F. Lewis): R. Trimen, *l. c.* (Ceylon).—(*c*) "They feed even on butterflies, which I have seen this species frequently capture": Jerdon, "Birds of India," I, p. 208 (2nd ed. 1877).—(*d*) "Nov. 14, 1891. On the Kandy Road between Trinkomali and Kanthalai; butterflies in great numbers sitting on the wet mud by the roadside; chiefly Pierinae (*Catophaga*), but a few *P*[*apilio*] *nomius* with them. These butterflies rose in clouds as one drove past. A Bee-Eater, *Merops philippinus*, kept flying in front of my carriage and taking specimens of these butterflies as they rose. The bird seemed to select the yellow females, which are rare, the white females being to them probably in the proportion of 100 to 1. . . . These Bee-Eaters were often seen catching Pierinae; in fact, it seems to have occurred so often that I ceased to record the fact": Col. J. W. Yerbury, Trans. Ent. Soc., Lond., 1902, p. 360.—(*e*) "I noticed clouds of butterflies, chiefly *Catopsilia*, migrating, crossing the Salween from east to west in a continuous stream. These were being persistently hawked by the *Merops*, mixed with which were some king-crows": Lt.-Col. C. T. Bingham, Trans. Ent. Soc. Lond., 1902, p. 363 (Burma).

24. *Merops viridis*, L., *M. philippinus*, L., and *Melittophagus swinhoei*, Hume. (*a*) Some Bee-Eaters ("which of the three species mentioned in my book was not sufficiently determined") were seen to capture *Papilio erithonius*, *P. hector* and *Precis iphita*, at Anaradhapura, Ceylon, in Jan. 1905: Dr. F. Doflein (letter dated 12, iv, 1907).—(*b*) At Vavuniya Vilankulam, North Ceylon, in Jan. 1905, all these three Bee-Eaters were observed to capture some of the following butterflies, *Papilio erithonius*, *P. hector*, *Hypolimnas bolina*, *H. misippus*, *Eronia spiculifera*, and *Hebomoia glaucippe*: Dr. Doflein, *l. c.*

25. *Merops apiaster*, L. (European Bee-Eater). Seen to capture a Lycaenid, probably *Polyommatus* (*Lampides*)

baeticus : Major Nurse, "Journ. Bomb. Soc.," xv, p. 349 (India).

25 bis. *Merops leschenaulti,* Vieill. (Leschenault's Bee-Eater). "These birds never eat the wings of butterflies. You see one of them swoop on to a butterfly close at hand; then you hear a little click of the bill, and as the bird flies off the pair of wings come slowly fluttering to the ground" : W. Davison, "Stray Feathers," vi, 1878, p. 68.

26. *Melittophagus swinhoei,* Hume (Swinhoe's Bee-Eater). (*a*) "Frequently capture *Catopsiliae,* especially when these butterflies are travelling in thousands along the river-valleys" (F. Lewis): R. Trimen, Proc. Ent. Soc. 1897, p. xci (Ceylon).—(*b*) "The butterflies hawked and eaten by the Bee-Eaters belong to the following species, *Papilio crithonius, P. sarpedon, Charaxes athamas, Cyrestis thyodamas,* and *Terias hecabe.* A meagre list, for I am certain I saw the Bee-Eaters swoop for and catch *Prioneris, Hebomoia, Junonia* and *Precis.* I also particularly noticed that the birds never went for a *Danais* or *Euploea,* or for *Papilio macareus* and *P. xenocles,* which are mimics of *Danais,* though two or three species of *Danais,* four or five of *Euploea,* and the two above-mentioned mimicking Papilios simply swarmed along the whole road": Lt.-Col. C. T. Bingham, Trans. Ent. Soc., 1902, p. 362 (Burma).

27. *Coracias indicus,* L. (Indian Roller). Observed catching butterflies in India: Major Nurse, "J. Bomb. Soc.," xv, p. 349.

28. *Coracias affinis,* McCl. (Burmese Roller). "Ataran River, 30, ii, 1881. Saw a *Coracias affinis* fly to a tree holding a *Cyrestis thyodamas* in its mouth" Lt.-Col. C. T. Bingham (note from diary).

29. *Halcyon smyrnensis,* L. (White-breasted Kingfisher). (*a*) "Very common, feeding indiscriminately on fresh- or salt-water fish, crabs, beetles and butterflies. I have seen them capture these last in the manner of flycatchers (Muscicapidae), darting from a sprig and seizing them in the air": E. L. Layard, "Ann. Mag. N. H." (2) xii, 1853, p. 172 (Ceylon).—(*b*) "I have observed one launch out from a high tree, in the manner described by Layard, on a butterfly": Capt. Legge, "Birds of Ceylon," i, p. 300 (1878).

30. *Microhierax fringillarius,* Drap. (Black-legged Falconet). (*a*) On 25 March, 1877, in Tenasserim, a nest of this species was found in a hole in a tree. "At the bottom of the hole, which was about eighteen inches deep, was a soft pad composed of flies and butterflies' wings, mixed with small pieces of rotten wood": J. Davidson, quoted by A. O. Hume, "Stray Feathers," v, 1877, p. 81.—(*b*) This Falconet was observed hawking *Papilio empedocles* at Sarawak, Borneo, in Sept. 1897: R. Shelford (*in litt.*).—(*c*) "Though feeding on birds, as a rule smaller, but undoubtedly occasionally larger than itself, the chief food probably of this little Falcon is insects of various sorts, dragonflies, beetles and butterflies. I say butterflies, for, although I have never found the distinguishable remains of butterflies in those I have examined, I have no doubt that they do capture butterflies largely, and of all sizes, for the nest of a pair that I found at Bankasoon [Burma] consisted of a pad composed entirely of insect-wings, and the mass of these were those of butterflies": W. Davison, "Stray Feathers," vi, 1878, p. 5.
31. *Microhierax coerulescens,* L. (Red-legged Falconet). (*a*) This bird was observed on March 20, 1881, in Burma, to capture and eat a *Papilio sarpedon:* Lt.-Col. C. T. Bingham, Trans. Ent. Soc., 1902, p. 364.—(*b*) From a nest of this species found in Burma in March 1878, the following butterflies' wings were taken—*Mycalesis perseus, Precis orithya, Symphaedra dirtea* ♀, *Charaxes* sp., *Papilio erithonius, Papilio caunus,* and some unidentified species of Lycaenidae: Lt.-Col. Bingham, *l. c.* p. 365.—(*c*) Another nest of the same species, also found in Burma, contained "a fairly firm pad of chips of wood, a few leaves, with an upper stratum quite two inches thick, composed almost entirely of the wings of cicadas, with a few butterfly and moth wings interspersed therein": Lt.-Col. Bingham, "Zoologist" (4), 1901, p. 224.
32. Birds not identified:—
(*a*) A specimen of the Lycaenid, *Panchala apidanus,* was certified by Mr. Godfery to have been mutilated by a bird: W. L. Distant, "Rhop. Malayana," p. 274. —(*b*) "I have never seen a bird seize one of the often very common, slow-moving and fearless, reddish-brown

Danaids; while the Pieridae, and especially the *Catopsiliae*, were often pursued by birds a long distance": E. Haase, "Researches on Mimicry" (transl.), ii, p. 23, note.—(*c*) A bird was seen to seize a butterfly, *Elymnias undularis* ♂, just as the observer was on the point of capturing it with his net: Prof. E. A. Minchin, Proc. Ent. Soc. L., 1904, p. xxxvii. (India.) —(*d*) "During five years I have, perhaps, seen a dozen attacks on butterflies by birds, and only seen them captured two or three times": J. C. Kershaw, Trans. Ent. Soc., 1906, p. 6 (S. China).—(*e*) "In Ceylon a bird was seen to make a swoop at a male *Catophaga paulina*, but missed it": Dr. G. B. Longstaff, Trans. Ent. Soc., 1905, p. 135.—(*f*) "I have often seen birds catch butterflies in Hongkong, Cochinchina, and Europe, but neither birds nor butterflies were identified": Dr. F. Doflein (letter dated 22, iv, 1907).—(*g*) "Hangtharaw River, 12, iv, 1881 [Burma]. On the march to-day I found under a tree by a stream quite a number of the wings of butterflies, chiefly Lycaenidae. These had apparently been sheared off by some bird that had fed on the flies. *Lampides* and *Nacaduba* abounded on the sandy banks": Lt.-Col. Bingham (note from diary).—(*h*) "I could never observe that this species [*Ornithoptera darsius*, Gray] was captured by the birds, though the much larger black and white *Papilio polymnestor*, Cram., often fell a prey to them, and nearly all those on the wing were damaged." It is then suggested that the *Ornithoptera* derives its immunity from the fact that its larva feeds on the poisonous Aristolochia. "But be that as it may, we always observe that this butterfly is uninjured, in spite of its slow, lazy and almost unwieldy flight among the birds; while the strong, quickly flying Papilios, *hector*, *erithonius*, *agamemnon*, *montanus*, *polytes*, etc., are seized": Dr. F. Doflein, "Ostasienfahrt," p. 444 (Ceylon).

Indo-Malayan Butterflies.

Danainae.

Danaida sp.—Merops viridis (22, *f*; butterfly rejected).
Tirumala septentrionis, Butl.—Dicrurus sp. (10; butterfly refused).

Euploea core, Cram.—Artamus fuscus (6).
E. rafflesii, Moore.—Dicrurus sp. (13).

Satyrinae.

Mycalesis perseus, F.—Microhierax coerulescens (31, *b*).
Melanitis zitenius, Hbst.—Dicrurus ater (9, *i*).
Elymnias undularis, Drury.—Bird (32, *e*).

Amathusiinae.

Melanocyma faunula, Westw.—Flycatcher (18).
Amathusia phidippus, Joh.—Passer montanus (19, *a*).

Acraeinae.

Acraea violae, F.—Otocampsa fuscicaudata (4).

Nymphalinae.

Pyramcis kaschmirensis, Koll.—Dicrurus ater (9, *h*).
Precis, spp.—Melittophagus swinhoei (26, *b*).
P. orithya, L.—Microhierax coerulescens (31, *b*).
P. iphita, Cram.—Merops sp. (24, *a*).
Hypolimnas bolina, L.—Merops sp. (24, *b*).
H. misippus, L.—Merops sp. (24, *b*).
Cyrestis thyodamas, Boisd.—Melittophagus swinhoei (26, *b*); Coracias affinis (28).
Neptis eurynome, Westw.—Terpsiphone paradisi (17).
Euthalia garuda, Moore.—Dicrurus ater (9, *c*).
Symphaedra dirtaea, F.—Microhierax coerulescens (31, *b*).
Charaxes sp.—Microhierax coerulescens (31, *b*).
C. psaphon, Westw.—Pycnonotus sp. (2); Merops viridis (22, *h*).
Eulepis athamas, Drury—Melittophagus swinhoei (26, *b*).

Lycaeninae.

Lampides baeticus, L.—Merops apiaster (25).
Zizera sp.—Passer montanus (19, *d*).
Panchala apidanus, Cram.—Bird (32, *a*).
Lycaenidae.—Microhierax coerulescens (31, *b*).

Pierinae.

Prioncris sp.—Melittophagus swinhoei (26, *b*).
Ixias marianne, Cram.—Terpsiphone paradisi (17).
Appias hippo, Cram.—Chibia hottentotta (8).
Catophaga sp.—Merops philippinus (23, *d*).

C. paulina, Cram.—Bird (32, *e*).
Catopsilia spp.—Copsychus saularis (1); Dicrurus ater (9, *j*); Buchanga sp. (14); Passer montanus (19, *b*); Merops philippinus (23, *b*, *c*); Melittophagus swinhoei 26, *a*).
Terias, spp.—Trogon (21); Merops viridis (22, *c*); M. philippinus (23, *a*).
T. hecabe, L.—Terpsiphone paradisi (17); Merops viridis 22, *g*); M. philippinus (23, *b*).
T. lacta, Boisd. (or *silhetana*, Wall.)—Dicrurus ater (9, *d*); M. viridis (22, *e*).
Teracolus sp.—M. viridis (22, *d*).
Hebomoia glaucippe, L.—Merops sp. (24 *b*); Melittophagus swinhoei (26, *b*).
Pareronia ceylanica, Feld.—Merops sp. (24, *b*).
Pierinae—Acridotheres tristis (20, *b*); Merops viridis (22, *d*).

Papilioninae.

Teinopalpus imperialis, Hope.—Dicrurus longicaudatus (11).
Papilio sp.—Acridotheres tristis (20, *a*).
P. hector L.—Merops sp. (24, *a*, *b*).
P. demoleus, L.—Dicrurus ater (9, *b*); Merops sp. (24, *a*, *b*); Melittophagus swinhoei (26, *b*); Microhierax coerulescens (31, *b*).
P. polymnestor, Cram.—Bird (32, *h*).
P. polytes, L.—Merops viridis (22, *g*).
P. caunus, Westw.—Microhierax coerulescens (31, *b*).
P. polyctor, Boisd. (or *arcturus*, Westw.)—Dicrurus ater (9, *g*).
P. nomius, Esp.—Merops philippinus (23, *d*).
P. sarpedon, L.—Melittophagus swinhoei (26, *b*); Microhierax coerulescens (31, *a*).
P. empedocles, F.—Microhierax fringillarius (30, *b*).

Hesperiidae.

Casyapa thrax, L.—Passer montanus (19, *b*).

Records from the Nearctic Region.

1. *Turdus migratorius*, L. (American Robin). Observed to attack and devour a large brown butterfly, but the wings were not eaten: G. A. Soper, "Nature," lxi, 1900, p. 49 (New Jersey).

2. *Turdus mustelinus*, Gm. (American Wood-Robin). *Colias philodice*, *Picris rapae* and *P. brassicae* are eaten by this bird: Gentry, "Life-Histories of Birds of E. Pennsylvania," 1876, i, p. 16.
3. *Sialia sialis*, L. (Blue-bird). "They [an immense concourse of *Terias lisa*, Boisd.] did not stay long upon the islands [Bermudas], however, only a few days, but during that time thousands must have fallen victims to the vigorous appetites of the blue-bird (*Sialia sialis*, Baird), and black-bird (*Mimus carolinensis*, Gray), which were continually preying upon them": J. M. Jones, "Psyche," i, p. 122.
4. *Mimus polyglottus*, L. (Mocking-bird). (*a*) "In Florida, as we have been informed by Mrs. Annie T. Slosson, the mocking-bird frequently chases butterflies": A. S. Packard, "Proc. Am. Phil. Soc. 1904," p. 401.—(*b*) "Diptera, mosquitoes, butterflies, larvae of non-irritating properties, earthworms and berries of divers kinds constitute their dietary": Gentry, "Life-Histories of Birds of E. Pennsylvania," i, p. 27.
5. *Mimus carolinensis*, L. (Cat-bird). Observed to prey largely on *Terias lisa*, Boisd. (v. *Sialia sialis*).
6. *Telmatodytes palustris*, Baird (Long-billed Marsh Wren). Its food comprises among other things "many of the Noctuidae and Lycaenidae in the condition of imagoes": Gentry, *op. cit.* i, p. 89.
7. *Myiodioctes pusillus*, Wils. (Green Black-capped Fly-catcher). Stomachs contained *Colias philodice:* Gentry, *l. c.* i, p. 168.
8. *Setophaga ruticilla*, L. (American Redstart). (*a*) Stomachs contained Lycaenidae: Gentry, *l. c.* i, p. 173.—(*b*) "The redstart feeds exclusively on an insect diet, consisting chiefly of flies, spiders, plant-lice, butterflies, beetles and different larvae": Dr. B. H. Warren, "Birds of Pennsylvania" (2nd ed.), p. 191.
9. *Dendroeca virens*, Gm. (Black-throated Green Warbler). Observed to have pursued and probably captured a *Pieris*, "apparently *Picris rapae*": A. S. Packard, "Proc. Am. Phil. Soc.," 1904, p. 397 (U.S.A.).
10. *Geothlypis trichas*, L. (Maryland Yellow-throat). "Prof. C. V. Weed, of Durham, N.H., writes that he saw an *Antiopa* butterfly in the mouth of a Maryland Yellow-throat": A. S. Packard, *l. c.* p. 401.
11. *Pyranga rubra*, Sw. (Scarlet Tanager). (*a*) A butterfly

found in one stomach: Dr. B. H. Warren, "Birds of Pennsylvania," p. 251.—(*b*) In stomachs of this bird were found "many of the Satyridae, Lycaenidae and Tortricidae": Gentry, *l. c.* i, p. 180.

12. *Hirundo erythrogaster*, Bodd. (American Swallow). Stomachs contained Lycaenidae: Gentry, *l. c.* i, p. 187.
13. *Progne subis*, Baird (American Purple Martin). "Mr. Otto Widman, who has observed the feeding habits of purple martins, found that the parent birds carried to their nestlings dragonflies, butterflies and moths, grasshoppers, beetles and flies": S. D. Judd, "Yearb. Dept. Agric. Washing.," 1897, p. 417.
14. *Tachycineta bicolor*, Vieill. (American White-bellied Swallow). Stomachs contained *Pieris rapae* and *Colias philodice:* Gentry, *l. c.* i, p. 189.
15. *Cotile riparia*, L. (Sand Martin). Stomachs contained Lycaenidae: Gentry, *l. c.* i, p. 196.
16. *Stelgidopteryx serripennis*, Aud. (Rough-winged Swallow). Stomachs contained *Colias philodice*, the smaller *Argynnis* and Lycaenidae: Gentry, *l. c.* i, p. 197.
17. *Vireo olivaceus*, L. (Red-eyed Vireo). "Prof. F. E. L. Beal found in the stomachs of some nestling birds, tree-hoppers, assassin bugs [Reduviidae], spiders, sphinx caterpillars and butterflies": S. D. Judd, "Yearb. Dept. Agric. Washing.," 1897, p. 416.
18. *Vireo flavifrons*, Vieill. (Yellow-throated Vireo). Observed to have eaten *Thecla humuli*, Harr. and *Argynnis bellona*, F.: Gentry, *l. c.* i, p. 221.
19. *Vireo solitarius*, Wils. (Blue-headed Vireo). Eats "small Lepidoptera, both diurnal and nocturnal": Gentry, *l. c.* i, p. 226.
20. *Vireo noveboracensis*, Gm. (White-eyed Vireo). Devours *Argynnis myrina* and *Thymele* (*Eudamus*) *tityrus*, F.: Gentry, *l. c.* i, p. 231.
21. *Lanius ludovicianus*, L. (Loggerhead Shrike). "Its food consists chiefly of grasshoppers, crickets, Coleopterous and other insects, including butterflies and moths, which it will pursue and capture on the wing": Dr. Bachman, quoted by Baird, Brewer and Ridgway, "Birds of N. America," i, p. 419.
22. *Melospiza fasciata*, Gm. (Song Sparrow). (*a*) Observed to feed on *Thecla humuli*, Harr.: Gentry, *l. c.* i, p. 287. —(*b*) Observed (with Chipping and Savannah sparrows) to catch and eat a few *Vanessa milberti*, *Pieris*

rapae and *Brenthis myrina:* Caroline G. Soule, quoted by Packard, *l. c.* p. 399 (U.S.A.).

23. *Spizella socialis*, Wils. (Chipping Sparrow). (*a*) Eats *Thecla humuli*, Harr.: Gentry, *l. c.* i, p. 300.—(*b*) "Chipping Sparrows, in my experience, will chase almost any butterfly and often kill kinds they do not seem to eat." Also recorded (with Savannah and Song Sparrows) as catching and eating a few *Vanessa milberti*, *Pieris rapae* and *Brenthis myrina:* Caroline G. Soule quoted by Packard, *l. c.* pp. 399 and 400 (U.S.A.).
24. *Passer domesticus*, L. (Sparrow). (*a*) Observed to capture a *Pieris rapae* on two occasions: L. H. Joutel and Prof. J. B. Smith, quoted by Packard, *l. c.* p. 399 (U.S.A.).—(*b*) In the investigation carried out in America on the food of the European Sparrow the following notes of attacks on butterflies are recorded: *Papilio turnus*, once; *Vanessa antiopa*, once; Yellow butterfly (? *Colias*), once; Cabbage butterfly, twice; Butterflies (kind not specified), 14 reports: W. B. Barrows, "The English Sparrow, U.S. Dept. Agr., Div. Econ. Ornith.," Bull. i," 1889, p. 102.
25. *Passerculus*, sp. (Savannah Sparrow). Observed (with Chipping and Song Sparrows) to catch and eat a few *Vanessa milberti*, *Pieris rapae* and *Brenthis myrina:* Caroline G. Soule, quoted by Packard, *l. c.* p. 399.
26. *Carduelis carduelis*, L. (Goldfinch). "I have seen thistle-finches attack [*Papilio*] *turnus* and [*Argynnis*] *cybele*, but not eat them": Caroline G. Soule, *l. c.* p. 399 (U.S.A.).
27. *Molothrus pecoris*, Gm. (Cow-bird). Stomachs contained *Colias philodice:* Gentry, *l. c.* i, p. 356.
28. *Agelaeus phoeniceus*, L. (Swamp Blackbird). Stomachs contained Lycaenidae: Gentry, *l. c.* i, p. 360.
29. *Sturnella magna*, L. (American Meadow Lark). Among other food "*Colias philodice* and many of the Lycaenidae, Tortricidae, are in great demand": Gentry, *l. c.* i, p. 365.
30. *Icterus spurius*, L. (Orchard Oriole). Stomachs contained Lycaenidae: Gentry, *l. c.* i, p. 371.
31. *Icterus baltimore*, L. (Baltimore Oriole). Stomachs contained "many of the Lycaenidae and Tortricidae": Gentry, *l. c.* i, p. 377.
32. *Tyrannus tyrannus*, L. (King-bird). (*a*) The young

birds are fed on *Colias philodice* and *Pieris oleracea*: Gentry, *l. c.* ii, p. 33.—(*b*) Observed to catch *Pieris rapae*: W. Dearden, quoted by Packard, "Proc. Am. Phil. Soc.," 1904, p. 401 (U.S.A.).—(*c*) "Last summer a pair of King-birds built their nest on a low limb of a tree close to our door. They consumed and fed to their young a great many butterflies, especially the Rape butterfly": Mrs. Mary Treat, quoted by Packard, *l. c.* p. 403.—(*d*) "Fyles states that he once lost a specimen [of *Oeneis jutta* (Arctic Satyr)] through a King-bird (*Tyrannus tyrannus*) which 'gave chase to the butterfly, and after much doubling and twisting, caught it and disposed of it effectually'": S. H. Scudder, "Butt. of E. Un. St. and Canada," i, p. 155.—(*e*) "On Center Island in the town of Oyster Bay [U.S.A.], in August 1902, I saw a King-bird (*Tyrannus tyrannus*) chase a *Colias*. I stood still and watched it for nearly a minute. It seemed to have great difficulty in getting the insect, and I could hear the beaks snap in the air in their unsuccessful attempts to close upon the insect. The persistence of the bird and the difficulty of the operation of catching the butterfly impressed me very much at the time": Prof. C. B. Davenport (letter dated 8, ii, 1909).—(*f*) "Summer before last I saw at a distance a bird, I think it was a King-bird but could not make out certainly, chasing one of the Pieridae, either a *Colias* or a *Pieris*, in the valley near the Laboratory [Long Island, New York]. These are all the cases I have in mind, but I have gained the impression that the thing was so common as not to deserve more careful noting": Prof. C. B. Davenport (*ibid.*).

33. *Myiarchus crinitus*, L. (Crested Flycatcher). (*a*) Butterflies found in the stomach of one specimen: Dr. B. H. Warren, "Birds of Pennsylvania," p. 191.—(*b*) Observed to eat *Colias philodice*, *Pieris oleracea* and Lycaenidae; from direct observation it was noted that "hosts of Lepidoptera, both larvae and imagoes, are devoured": Gentry, *l. c.* ii, p. 40.

34. *Empidias fuscus*, Gm. (Pewee). (*a*) The young are fed on *Colias philodice* and Lycaenidae: Gentry, *l. c.* ii, p. 52.—(*b*) Observed to catch *Pieris rapae*, or a similar species: F. P. Drowne, quoted by Packard, "Pr. Am. Phil. Soc.," 1904, p. 401 (Virginia).—(*c*) Observed

to catch a small butterfly: W. Dearden, quoted by Packard, *l. c.* (U.S.A.).

35. *Contopus virens*, L. (Wood Pewee). (*a*) Stomachs contained insects, including butterflies: Dr. B. H. Warren, "Birds of Pennsylv.", p. 194.—(*b*) Observed to eat *Colias philodice*, *Argynnis myrina*, *Grapta interrogationis*, *Chrysophanus americanus*, other Lycaenidae and Satyrinae: Gentry, *l. c.* ii, pp. 64 and 65.
36. *Empidonax acadicus*, Gm. (Small Green-crested Flycatcher). (*a*) Stomachs contained Satyrinae and Lycaenidae: Gentry, *l. c.* ii, p. 67.—(*b*) "Its food consists of insects during spring and summer, such as moths, wild bees, butterflies, and a variety of small kinds": J. J. Audubon, "Ornith. Biogr.," ii, p. 257.
37. *Chordeiles virginianus*, Gm. (Virginian Goatsucker). Stomachs contained *Argynnis aphrodite*, *Pyrameis cardui*, *Chrysophanus americanus*, and many of the Satyrinae and Lycaenidae; the young are fed also on *Pieris oleracea*: Gentry, *l. c.* ii, pp. 95 and 96.
38. *Chaetura pelagica*, L. (Spine-tailed Swift). The young are fed on Lycaenidae, etc.; the old birds also eat *Argynnis aphrodite* and *Pyrameis cardui*: Gentry. *l. c.* ii, pp. 101 and 102.
39. *Coccyzus americanus*, L. (Yellow-billed Cuckoo). (*a*) "They feed on insects such as caterpillars and butterflies, as well as on berries": J. J. Audubon, "Ornith. Biography," i, p. 19.—(*b*) Stomachs contained *Pieris rapae* and Lycaenidae: Gentry, *l. c.* ii, p. 118.
40. *Coccyzus erythrophthalmus*, Wils. (Black-billed Cuckoo). Stomachs contained Lycaenidae: Gentry, l.c. ii, p. 114.
41. *Dendrocopus villosus*, L. (Hairy Woodpecker). Stomachs contained Lycaenidae: Gentry, *l. c.* i, p. 130.
42. *Melanarpes erythrocephalus*, L. (Red-headed Woodpecker). Stomachs contained Lycaenidae: Gentry, *l. c.* ii, p. 153.
43. *Falco sparverius*, L. (American Kestrel). (*a*) Stomachs contained "a few of the Papilionidae and Sphingidae": Gentry, *l. c.* ii, p. 252.—(*b*) A butterfly was found in the stomach of a bird shot at Cataract Creek, Arizona: Dr. A. K. Fisher, "Hawks and Owls of the U. S.", 1893, p. 126 (U. S. Dept. Agr., Div. Econ. Ornith., Bull. iii.).
44. *Falco communis*, Gm. (Peregrine). Stomachs contained Papilionidae: Gentry, *l. c.* ii, p. 242.

45. *Accipiter fuscus*, Gm. (Sharp-shinned Hawk). Stomachs contained "many of the larger Papilionidae and Sphingidae": Gentry, *l. c.* ii, p. 240.
46. *Accipiter cooperi*, Bonap. (Cooper's Hawk). Stomachs contained Papilionidae: Gentry, *l. c.* ii, p. 235.
47. Birds not identified:—
(*a*) "I have on several occasions seen butterflies captured by birds and have seen dragon-flies dart after them": C. V. Riley "3rd Missouri Report," 1871, p. 167.—(*b*) "Mr. Otto Lugger of Chicago, while on the U. S. Lake Survey, once saw a bird dart after an *archippus* [= *plexippus*] butterfly, seize it and immediately drop it without devouring the body": C. V. Riley, *l. c.* p. 169, note.—(*c*) "But butterflies are certainly sometimes eaten with us, for several cases are on record where capture has been seen, and I have myself noted one instance where *Euphoeades troilus* was unquestionably captured at no great distance from me by a bird. . . . Nearly all the prominent instances that have been mentioned have been taken from the tropics, where I have no doubt the perfect butterflies form a not inconsiderable portion of the food of many birds": S. H. Scudder, "Butterflies of Eastern U. S. and Canada," p. 1612.—(*d*) "*Turnus* [= *Papilio glaucus*, L.] has many enemies, birds and dragonflies by day, and probably small owls and others by night": Edwards, quoted by Scudder, *l. c.* ii, p. 1303.

Nearctic Butterflies.

Danainae.

Anosia plexippus, L.—Bird (47, *b*; butterfly rejected).

Satyrinae.

Oeneis jutta, Hübn.—Tyrannus tyrannus (32, *d*).

Satyrinae.—Pyranga rubra (10, *b*); Contopus virens (35, *b*); Empidonax acadicus (36, *a*); Chordeiles virginianus (37).

Nymphalinae.

Argynnis spp.—Stelgidopteryx serripennis (16).

A. aphrodite, F.—Chordeiles virginianus (37); Chaetura pelagica (38).

A. cybele, F.—Carduelis carduelis (26).

Brenthis myrina, Cram.—Vireo noveboracensis (20); Melospiza fasciata (22, *b*); Spizella socialis (23); Passerculus sp. (25); Contopus virens (35, *b*).

Brenthis bellona, F.—Vireo flavifrons (18).

Polygonia interrogationis, F.—Contopus virens (35, *b*).

Vanessa milberti, Godt.—Melospiza fasciata (22, *b*); Spizella socialis (23); Passerculus sp. (25).

V. antiopa, L.—Geothlypis trichas (10); Passer domesticus (24, *b*).

Pyrameis cardui, L.—Chordeiles virginianus (37); Chaetura pelagica (38).

Lycaeninae.

Heodes hypophleas, Boisd.—Contopus virens (35, *b*); Chordeiles virginianus (37).

Thecla melinus, Hübn.—Vireo flavifrons (18); Melospiza fasciata (22, *a*): Spizella socialis (23).

Lycaeninae.—Telmatodytes palustris (6); Setophaga ruticilla (8, *a*); Pyranga rubra (11); Hirundo erythrogaster (12); Cotile riparia (15); Stelgidopteryx serripennis (16); Agelaeus phoeniceus (28); Sturnella magna (29); Icterus spurius (30); I. baltimore (31); Myiarchus crinitus (33, *b*); Empidias fuscus (34, *a*); Contopus virens (35, *b*); Empidonax acadicus (36, *a*); Chordeiles virginianus (37); Chaetura pelagica (38); Coccyzus americanus (39, *b*); Coc. erythrophthalmus (40); Dendrocopus villosus (41); Melanerpes erythrocephalus (42).

Pierinae.

Pieris rapae, L.—Turdus mustelinus (2); Dendroeca virens (9); Tachycineta bicolor (14); Melospiza fasciata (22, *b*); Spizella socialis (23): Passer domesticus (24, *a*, *b*); Passerculus sp. (25); Tyrannus tyrannus (32, *b*, *c*); Empidias fuscus (34, *b*); Coccyzus americanus (39, *b*).

P. brassicae, L.—Turdus mustelinus (2).

P. oleracea, Harr.—Tyrannus tyrannus (32, *a*); Myiarchus crinitus (33, *b*); Chordeiles virginianus (37).

Colias sp.—T. tyrannus (32, *c*).

C. philodice, Godt.—Turdus mustelinus (2); Myiodioctes pusillus (7); Tachycineta bicolor (14); Stelgidopteryx serripennis (16); Molothrus pecoris (27): Sturnella magna (29); Tyrannus tyrannus (32, *a*);

Myiarchus crinitus (33, *b*); Empidius fuscus (34, *a*); Contopus virens (35, *b*).

Terias lisa, Boisd.—Sialia sialis (3); Mimus carolinensis (5).

Pierinae.—Passer domesticus (24, *b*); T. tyrannus (32, *f*).

Papilioninae.

Papilio glaucus, L.—Passer domesticus (24, *b*); Carduelis carduelis (26); Birds (47, *d*).

P. troilus, L.—Bird (47, *c*).

Papilioninae.—Falco sparverius (43); Falco communis (44); Accipiter fuscus (45); Accipiter cooperi (46).

Hesperiidae.

Epargyreus tityrus, F.—Vireo noveboracensis (20).

Records from the Neotropical Region.

Vireo olivaceus, L. (Red-eyed Vireo). "I have seen one in eager, but unsuccessful pursuit of a butterfly (*Terias*)": P. H. Gosse, "Birds of Jamaica," p. 194.

Muscivora regia, Gm. "Feeds principally, and perhaps exclusively, upon butterflies. . . . M. Jelski's opinion, that the crest of these birds [which is said to resemble a flower—G. A. K. M.] serves as a lure for butterflies, appears to me to be correct": Stolzmann, quoted by Taczanowski, "Ornithologie du Pérou," ii, p. 296.

Pachyrrhamphus versicolor, Hartl. "In their stomachs I have found butterflies, larvae and rather hard bugs": Jelski, quoted by Taczanowski, *l. c.* p. 367 (1884).

Galbula sp. (Jacamar). (*a*) "It feeds entirely on insects . . . and as soon as a fly, butterfly or moth passes by, it darts at it and returns to the branch it had just left": C. Waterton, "Wanderings in S. America,' p. 123 (1839).—(*b*) "Pöppig states in regard to the closely-related Galbulidae 'that in the forests there is no difficulty in recognising the favourite perch of a *Galbula*, for the wings of the largest and most splendid butterflies, whose bodies alone are eaten, cover the ground for some steps around'": E. Haase, "Researches on Mimicry" (transl.), ii, p. 101.

Brachygalba melanosterna, Scl. (Black-chested Jacamar). Natterer records that in Brazil this bird sits on the twigs of the highest trees and hunts for butterflies: Von Pelzeln, "Sitzb. K. Akad. Wiss. Wien," xx, 1856, p. 518.

Malacoptila fusca, Gm. (White-breasted Softwing). "The Prince von Wied found in the stomach of *Monastes fusca*, a Bucconid, 'a large butterfly which crumpled up together filled almost the whole stomach'": E. Haase, *l. c.* p. 101.

Nyctibius aethereus, Wied. "These wide-mouthed birds are a particular enemy of various large and beautiful Lepidoptera, as I have been able to fully satisfy myself. They consume these insects in quantities, and the traces of their meals may be found in the large rejected wings which lie about in numbers on the ground in the Brazilian forests . . . Thus may be found the largest and most beautiful of the Brazilian Lepidoptera, [*Morpho*] *menelaus*, [*Caligo*] *idomeneus*, *Phalaena agrippina* [*Noctua strix*, L.], and many others": Max. Prinz zu Wied, "Beitr. z. Naturgesch. von Brazilien," iii (1), p. 309, (1830).

Sandpiper. The butterflies which often collect in large numbers in damp places were not observed to be attacked by insectivorous birds "except certainly by the Sandpipers (Strandläufern), which, like the lizards, are never particular": P. Hahnel, "Iris," 1890, p. 317 (Amazons).

Birds not identified:—

(*a*) "I observed a pair of birds that were bringing butterflies and dragonflies to their young, and although the *Heliconii* swarmed in the neighbourhood and are of weak flight so as to be easily caught, the birds never brought one to their nest": T. Belt, "Naturalist in Nicaragua," p. 316.—(*b*) Of a Brazilian bird called "Suruquá," the author states that "its principal food consists of butterflies and other soft-bodied insects": T. P. Bigg-Wither, "Pioneering in S. Brazil," i, p. 292.—(*c*) "No other group of butterflies is so much sought after by birds as the Pieridae, and these freebooters have often snatched away from me at my very side the most beautiful and perfect specimens. The unerring accuracy of their flight filled me with wonder on every occasion, and I was glad to pay for the exhibition by the loss of a specimen. Once, however, I was even more astonished, when I witnessed the lucky escape of a hunted butterfly. On this occasion it was no Pierid, but a great *Caligo*, which I had aroused and which one of these highwaymen

pursued forthwith. With incredible agility this huge insect managed to evade all the attacks of the closely pursuing bird, escaping out of one bush into another. It was an even race, which I watched with the deepest interest, until at last the hunted creature saved itself in a thicket of tangled branches and the wearied bird desisted from further pursuit": Paul Hahnel, "Iris," 1890, p. 193 (Venezuela).

Records from the Australian Region.

Sisura inquieta, Lath. (Restless Flycatcher). "The food of this species consists chiefly of insects of various kinds, principally flies, small moths and butterflies, captured more frequently while on the wing": A. J. North, "Nests and Eggs of Birds of Australia," p. 136.

Microcca fascinans, Lath. (Brown Flycatcher). "Its food consists principally of flies, small moths and butterflies, captured while on the wing": A. J. North, *op. cit.*, p. 150.

Petrocca leggei, Shafer (Scarlet-breasted Robin). "Its food consists of insects, principally small moths, butterflies, beetles, etc.": A. J. North, *op. cit.*, p. 164.

The paucity of records from the Neotropical Region is very striking and much to be deplored, for such information as we have seems to indicate that the destruction of butterflies by birds must occur there on a considerable scale. It is curious that not one of those excellent observers, Wallace, Bates, Fritz Müller or Belt, has given us a single record of attack in which either bird or butterfly was identified. Possibly they may have considered, like some other naturalists whom I have consulted, that the phenomenon was of such frequent occurrence as not to require special noting. It is to be hoped that the publication of this paper may do a little towards dispelling that idea. We want heaps more evidence before we can arrive at any sound conclusions as to the exact relations which exist between butterflies and their bird enemies. The publication of isolated cases is of little value; the evidence to carry weight must be in bulk. I propose to continue collecting it, and shall be very grateful to any correspondents who may be kind enough to assist me with any further records. Communications may be addressed to 6 Chester Place, Hyde Park Square, London, W.